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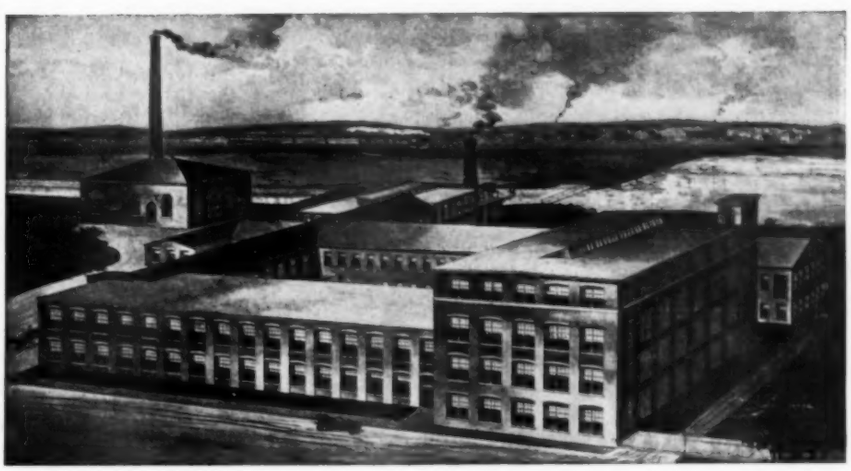

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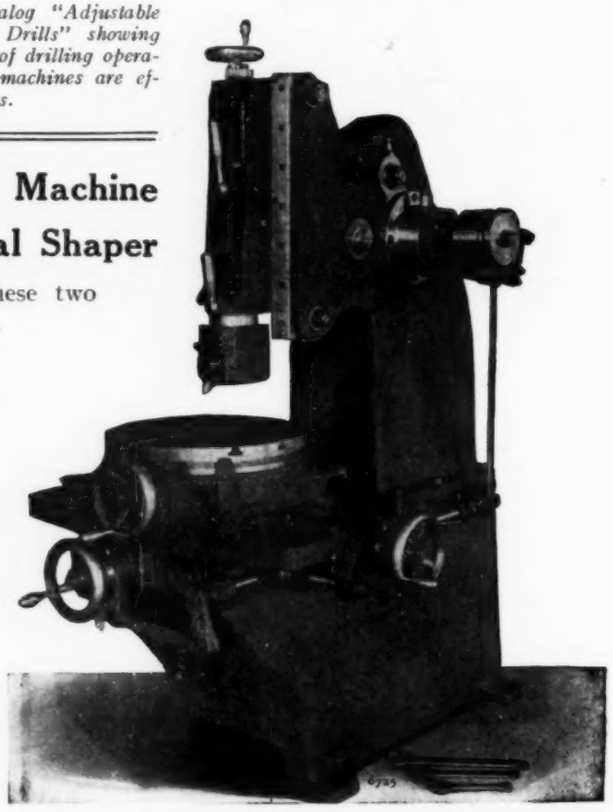

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Making Edison Phonographs

By Ethan Viall

Details of the shop practice of a large factory in the manufacture of phonograph mandrels, feed screws and feed nuts, illustrating the care given to each operation.

It is not the intention of this or future articles to describe the principles of sound recording or reproduction, as done by the phonograph, invented by Thomas A. Edison. The machining and manufacturing methods, however, used in producing the principal parts of Edison phonographs will be gone into in detail, and for the first time in any magazine.

The Edison Phonograph Works, Orange, N. J., manufactures a number of cylinder models, the better known ones being the Home, Standard, Amberola, Opera, Triumph and Gem, which are intended for use in the home or public hall for pleasure purposes. In addition to these a good sized portion of the factory's output consists of the business phonographs so extensively used in offices to take the place of the old-time stenographer.

The immense capacity of the Edison factory can be fully realized only by one familiar with mechanical production, who spends days studying the various departments. Great care is taken to turn out interchangeable and perfect goods, and rigid inspection is in evidence everywhere. In fact, one wonders how such care can be taken with the various parts and yet permit selling them at so reasonable a price. The painstaking care given to everything in connection with the output reflects the personal habits, policy and life work of the head of it all—Thomas A. Edison.

No attempt will be made to start at the beginning or to confine descriptions of the processes to any one model, but as the various parts are taken up, mention will be made of the model to which each belongs.

Machining the Mandrels

The tapered brass mandrels, over which the wax cylinders are placed when in use, differ but slightly in the various models, all being made from drawn-brass shells into which a spindle is fitted. The mandrels used for the Home phonograph probably are the most representative of all. In routing these through, the first thing is to bore the hole in the small end of the shell, counterbore the large end and trim it to length; which is done as shown in Fig. 1, the shell being held in the fixture *A* which is screwed onto the nose of the lathe spindle, the outer end running in the steady-rest *B*.

The drawn shell is merely pushed into

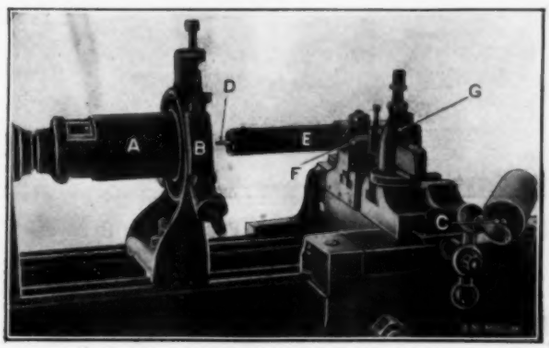


Fig. 1. Boring, Counterboring and Trimming to Length

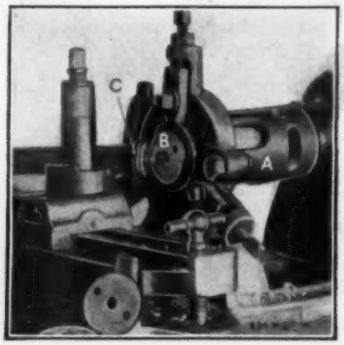


Fig. 2. Rolling the Head in Place

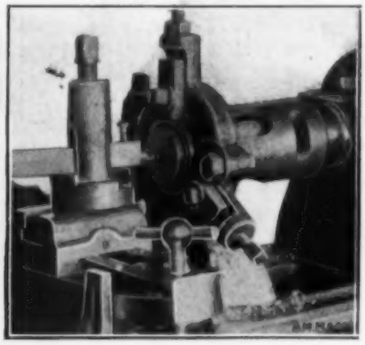


Fig. 3. Boring Out the Head for Shaft

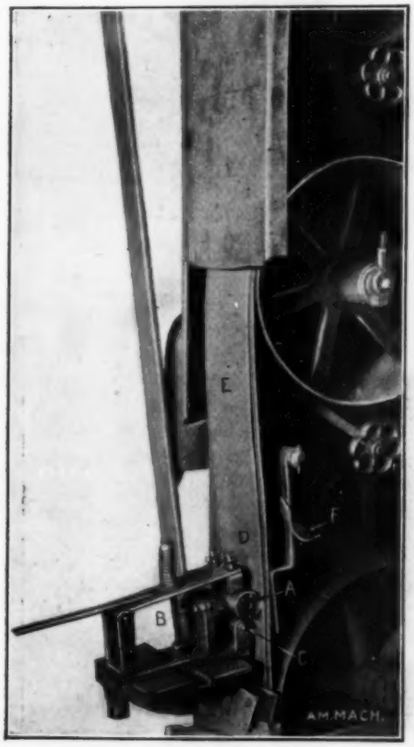


Fig. 4. Grinding Mandrels

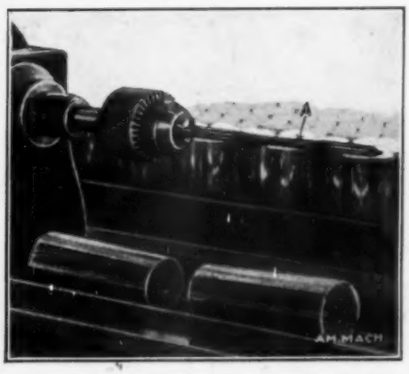


Fig. 5. Line Reaming Spindle Holes

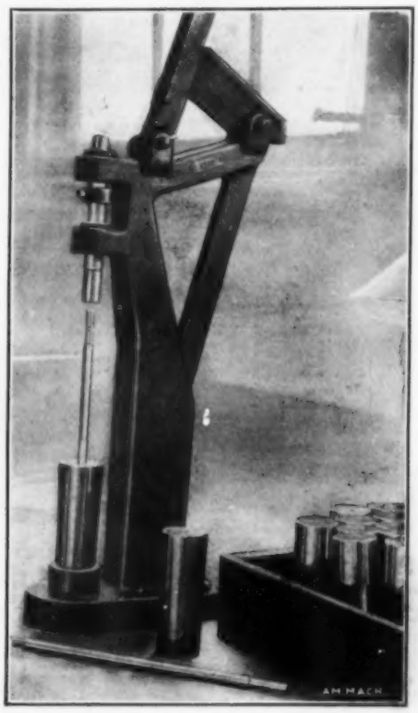


Fig. 6. Pressing in Shafts

the holder by hand and is held in place by friction, the taper, of course, allowing each shell to enter exactly the same distance, so that a trimming tool set into the carriage and run against a stop will trim all the shells, exactly the same length. When the shell is finished it is knocked out of the holder by means of a rod run through the spindle which strikes a pad and forces the shell out.

The small hole *C* which is punched through during the drawing process, is bored out with the tool *D*, the holder *E* of which is bolted solidly to the tool rest as shown. The large end of the shell is trimmed to length and counterbored by the tool *F* held in the tool post *G*.

Rolling in the Heads

After leaving the machine just described, the shells are placed in the fixture shown at *A*, Fig. 2 (which is similar to the one just shown) and a punched disk *B* is placed in the counterbore, the edge of the shell is spun or rolled over onto this with the tool *C* which firmly fixes the head in place. Next the shells go to another machine, Fig. 3, and the head is bored out for the shaft as shown.

Grinding, Polishing and Plating

The shells or mandrels now go to the grinding machine shown in Fig. 4. They are held at *A* between the rollers *B* and *C*, and the guide clamp *D* and are ground by the emery belt *E*, which is pressed against the mandrel by means of the hand lever *F*. The grinding is done about as fast as a man can handle the pieces.

After grinding, the mandrels are polished in the regular way, then nickel

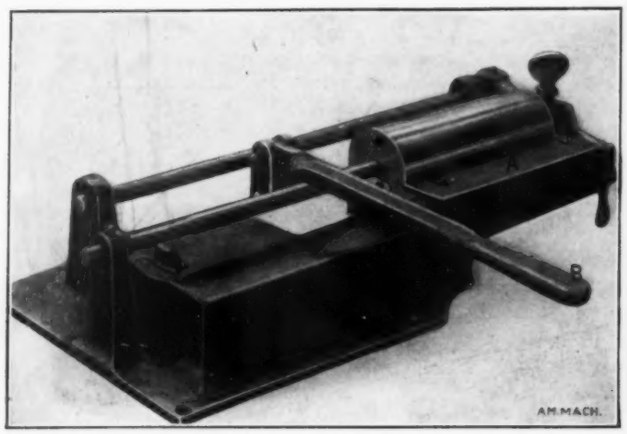


Fig. 7. Truing up Mandrel and Shaft

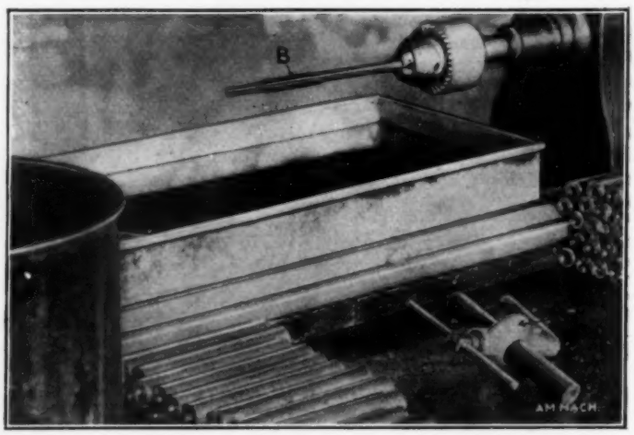


Fig. 8. First Reaming Operation on Feed Screw Sleeves

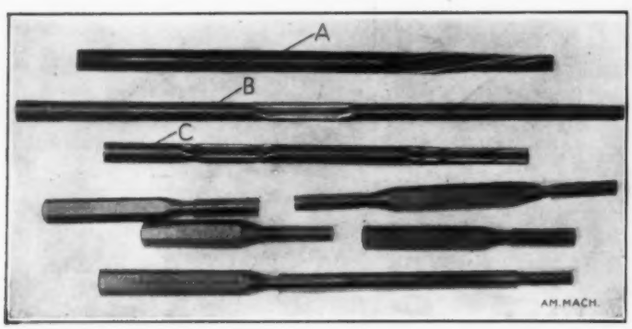


Fig. 9. Set of Reamers and Gages used for Feed Screw Sleeves

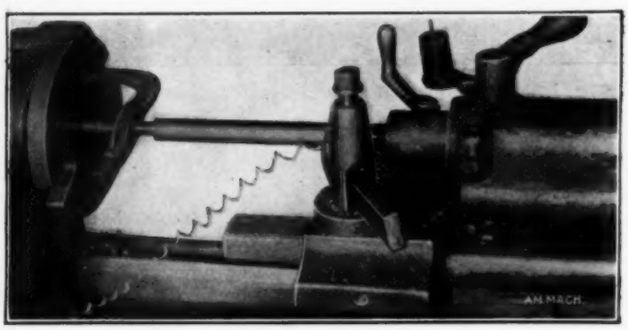


Fig. 10. Turning Outside, with the Sleeve on a Hardened Mandrel

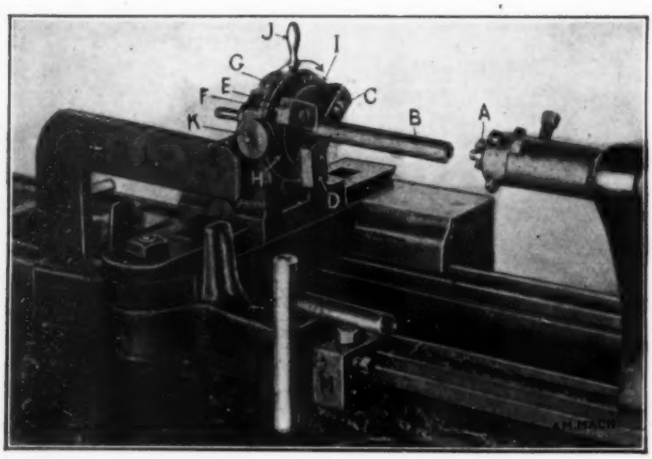


Fig. 11. Facing to Length and Chamfering

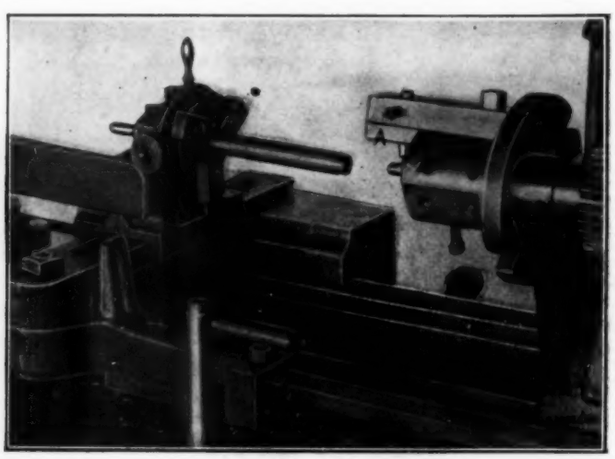


Fig. 12. Turning Clearance with a Piloted Tool

plated, buffed and returned to the machine shop, where the spindle holes are reamed by holding the mandrels by hand and running them over the double reamer *A*, Fig. 5, which insures the holes being exactly in line.

Pressing in the Shafts and Truing Up

The finished spindles or shafts are pressed into the mandrels in the small hand press, Fig. 6, and then trued up in the device shown in Fig. 7, in which they are held in practically the same way as they are to be mounted in a phonograph.

In using this device the mandrel is rotated and its truth determined by its relation to the gage *A*. Inaccuracies are corrected by springing the shaft with the lever *B* until it runs true.

Leadscrew Work

While all working parts of an Edison phonograph are accurate within very narrow limits, especial care is taken to produce good feed screws which are used for feeding the carriage, or speaker arm, as it is called, along the wax cylinder. Not only are the machining methods unusually accurate and the inspection rigid, but great care is taken in obtaining steel that will give a smooth thread and yet have wearing qualities as great as can be obtained without hardening.

Of the several styles of feed screws the more interesting, from a mechanical standpoint, are those used on the Home phonograph, the main part of which consists of a threaded steel sleeve fitted over an accurate shaft, on which it is turned by gears at a rate to give the correct feed for the two- or four-minute records, according to which is being used.

The blanks for the Home-model screws are drilled and cut to length from long bars in a screw machine, a $\frac{5}{16}$-in. hole being drilled entirely through each piece and then this hole is enlarged to $\frac{3}{8}$ in. to a shoulder within $\frac{3}{8}$ in. of the end.

Reaming the Sleeves

In order to have the hole through the sleeve as accurate as possible, a number of reaming operations is necessary, the first being shown in Fig. 8, the blank being held in an ordinary lathe dog fitted with a T-handled screw as shown at *A*. Locked in this way the blank is held in the hand and run over the reamer *B* which rough reams the large hole and reams the small one.

Next the large hole is pilot reamed, after which both holes are reamed in line with a double reamer, the three reamers used being shown enlarged at *A*, *B* and *C*, Fig. 9. The plug limit gages are shown just below them.

Turning Operations

The sleeves are now pressed on a mandrel, rough turned and then finish turned as shown in Fig. 10, then they are chamfered on one end as shown in Fig. 11.

The machine is interesting in a number of ways. A piloted chamfering tool is held in the lathe spindle at *A* and the screw sleeve *B* is held in the chuck as shown. Not only is the chuck itself unusual, but so is the method of operating it.

The jaws *C*, *D* and *E* are toothed or corrugated on the ends coming in contact with the work and are not set so that they will be radial, but are somewhat tangent when locked. Pins like the one at *F* connect the jaws to the disk *G* so that if the disk is turned slightly in the direction shown by the arrow the jaws will open, and when the disk is allowed to turn freely the springs *H*, *I*, and another not shown, will pull the jaws onto the work, gripping it tight. Any twisting of the work caused by the cutting has a tendency to make the jaws grip more firmly.

The view shows the device from the back, so it will be seen that if the operator pulls the handle *J* toward him he will open the chuck, also if he runs the carriage back the roller *K*, mounted on the disk *G*, will mount the track *L* and open the chuck the same as if the handle *J* were pulled.

All the operator, therefore, has to do in using this device is to run the carriage back, which opens the chuck; insert a piece, run the carriage forward until the roller runs off the end of the track and allows the chuck jaws to grip, then feed the piece to the cutting tools till the carriage reaches the stop *M* which has been set so that the tools will cut the sleeve to the exact length and chamfer the outside edge.

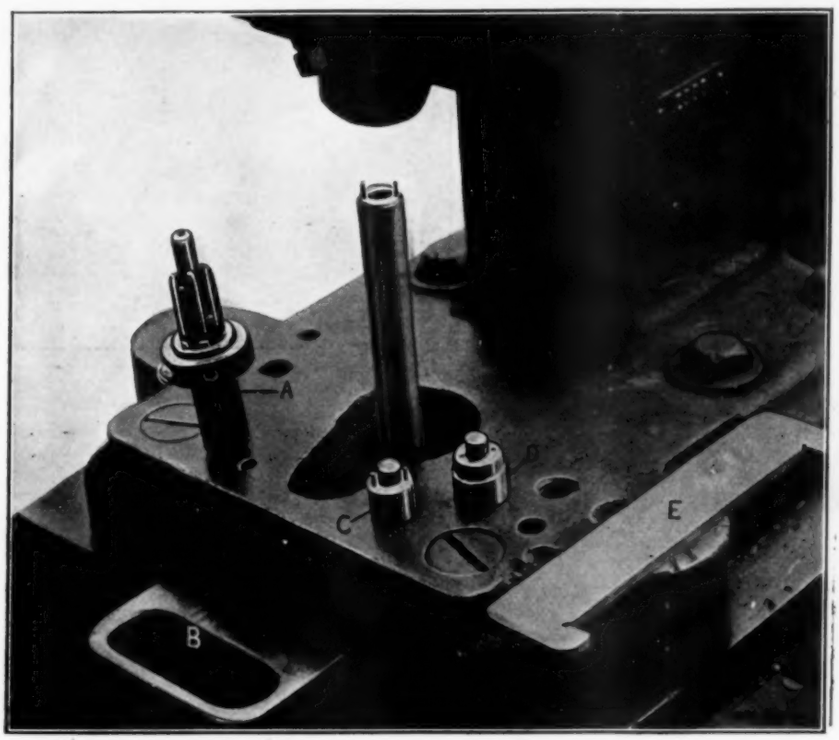


Fig. 15. Stamping and Pin-setting Tools

Fig. 13. Polishing the Clearance with Strip of Emery

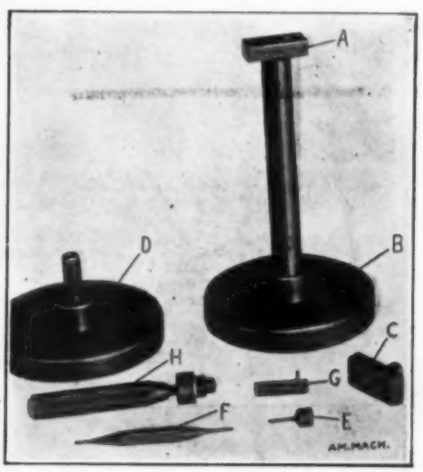


Fig. 14. Jig and Stand for Drilling Pin Holes

It will be seen from this that the method of opening and closing the chuck leaves the operator's left hand free to handle the work, while his right moves the carriage back and forth.

The clearance on the opposite end of the sleeves is cut in the same machine, using a piloted tool as shown at *A*, Fig. 12, then the sleeves are placed in the drilled in an ordinary driller, using the jig and stand shown at *A* and *B*, Fig. 14, a similar jig and stand being shown at *C* and *D*. In using these drilling jigs, one hole is drilled, the pin *E* is inserted and the second hole drilled, after which the holes are reamed.

The limit plug gage *F* is used for the drilled holes; *G* is a depth gage and *H* a hammer and the tool shown at *A*, Fig. 15, then the pins are pressed in with the arbor press shown, the screw blanks being set over a pin in the slide *B*, which may be drawn outward, making it possible to lift the blank off the pin without striking the ram of the press.

In order that the pins may be pressed in the correct depth and without being bent, the holders shown at *C* and *D* are used. These have holes in them the same depth as the amount the pins are to project from the end of the sleeve, and also a pilot which fits the hole in the sleeve, so that all that is necessary is to place two pins in the holder, place the holder over the end of the sleeve, so that the pins register over the reamed holes, and press the holder down as far as it will go. A gage *E* is used to inspect the height of the pins to be sure that they are being pressed in correctly.

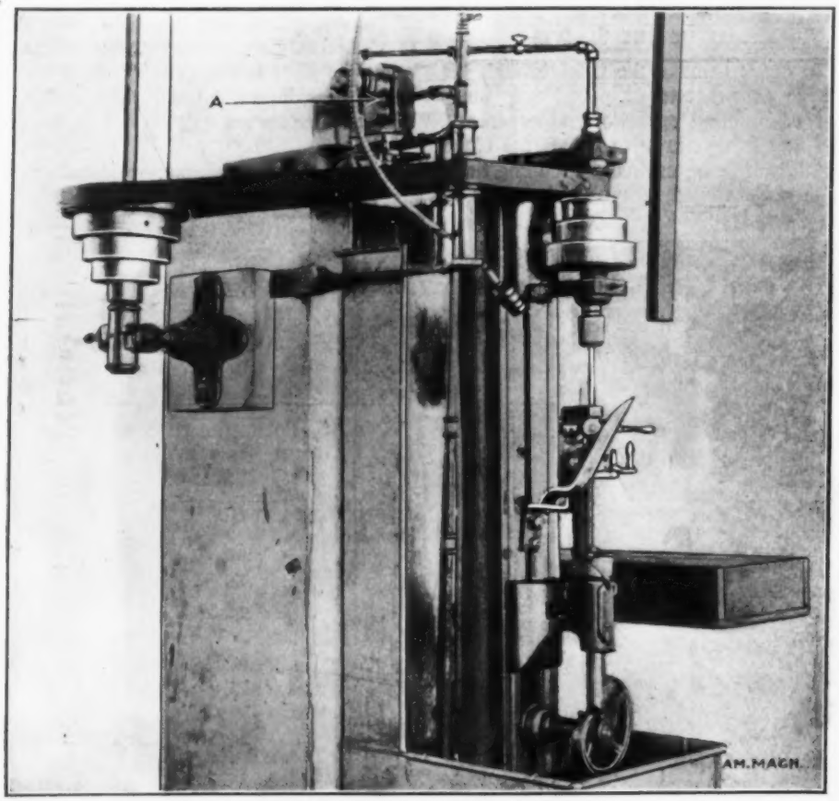


FIG. 16. FINISH REAMING MACHINE

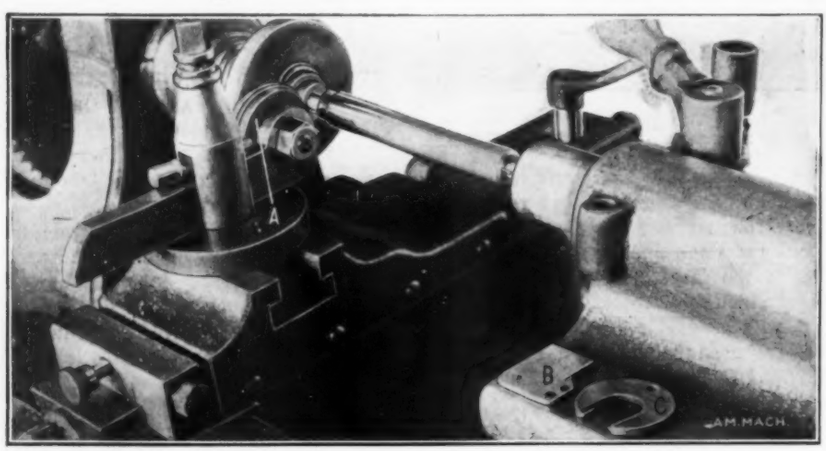


FIG. 18. CUTTING THE GROOVE IN THE CLEARANCE END

AN AUTOMATIC REAMING MACHINE

The final reaming of the sleeve is done in a reaming machine shown in Fig. 16 which automatically does the work, the operator simply dropping in and removing the pieces from the chuck. This halftone will give a good idea of the general features of the machine. The pump supplying the reamer with oil, is shown at *A*, but the chucking mechanism which

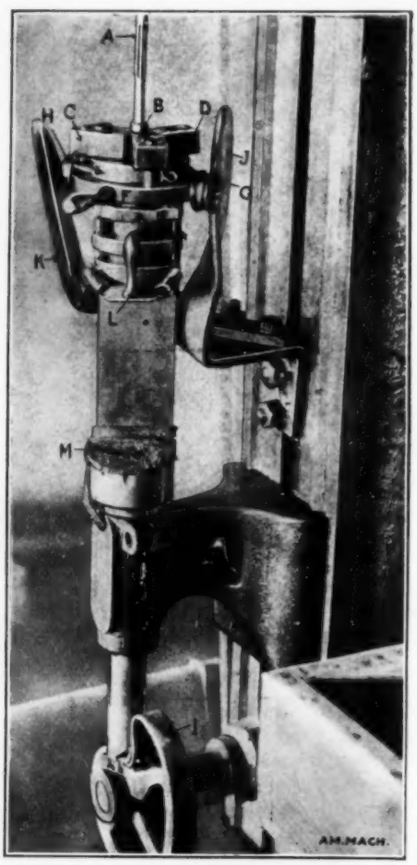


FIG. 17. DETAILS OF CHUCK OPERATING MECHANISM

split chuck and the clearance polished with a strip of emery cloth as shown in Fig. 13.

DRILLING THE PIN HOLES

The holes for the two little pins which are set into the end of the sleeves are is for the size and position of the reamed holes.

STAMPING AND SETTING THE PINS

After the pin holes have been drilled and reamed the model and serial number of the screw is stamped in the end with

resembles the one shown in Fig. 11 is shown enlarged in Fig. 17.

Details of the Chucking Mechanism

In this illustration the double reamer is shown at *A* and the screw sleeve at *B*, the chuck jaws *C*, *D* and *E* are connected by pins to the disk *F* which carries the two rollers *G* and *H*, so that as the chuck is moved up by means of the cam *I*, the chuck jaws close, and as the cam allows the chuck to descend the rollers *G* and *H* strike the cam-guides *J* and *K*, causing the disk *F* to rotate and open the chuck jaws. When the slide *L* is pulled out the screw sleeve drops down onto the pad *M* and as the slide is released, another piece is dropped into the chuck from above and the chuck, closing as the rollers leave the cam-guides, carries the work to the revolving reamer. The working of the machine is exceedingly simple, as will be seen once the principle is grasped.

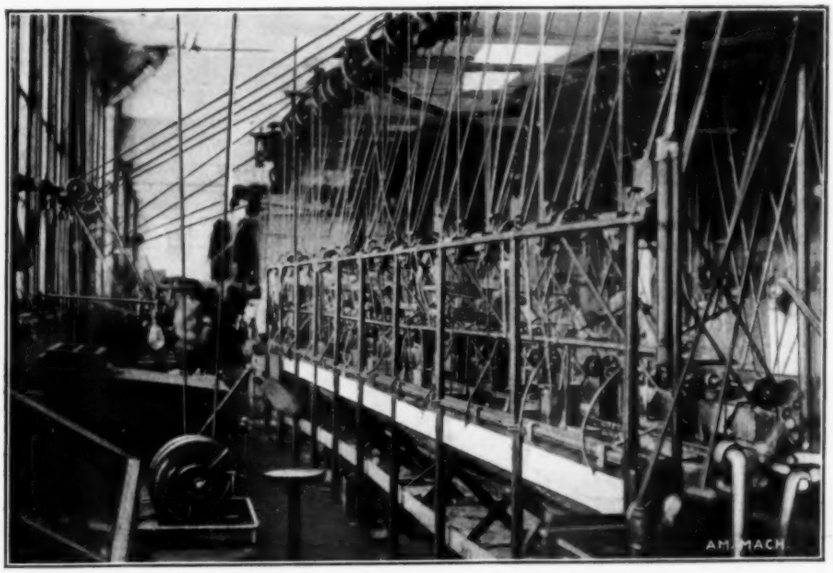


Fig. 19. Battery of Feed Screw Threading Lathes

Grooving

After reaming, a groove is cut near the end as shown in Fig. 18, a forming tool *A* being used. The gages for testing the distance of the groove from the end of the piece and for testing the depth, are shown at *B* and *C* respectively.

Threading

The threading is done on Sloan & Chace bench lathes, of which there are 32 in use for this purpose alone. A part of one row is shown in Fig. 19, and gives a good idea of the belting arrangement. The threads cut are of buttress form, 100 to the inch, with chasers, one of the partly threaded sleeves being shown in Fig. 20.

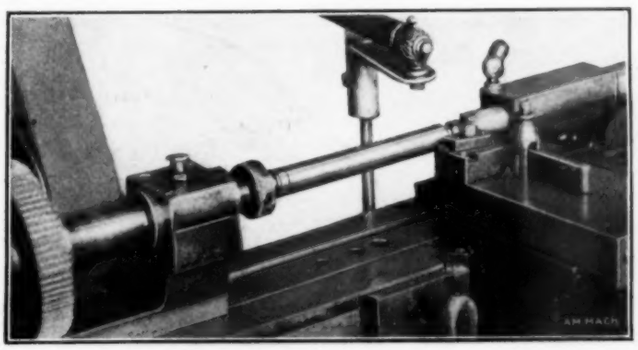


Fig. 20. One of the Chasing Lathes

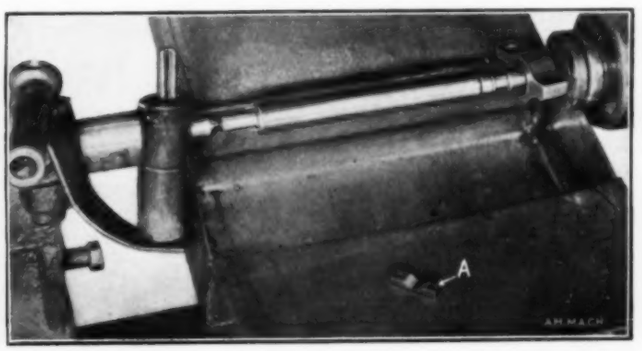


Fig. 21. Method of Finishing the Threads

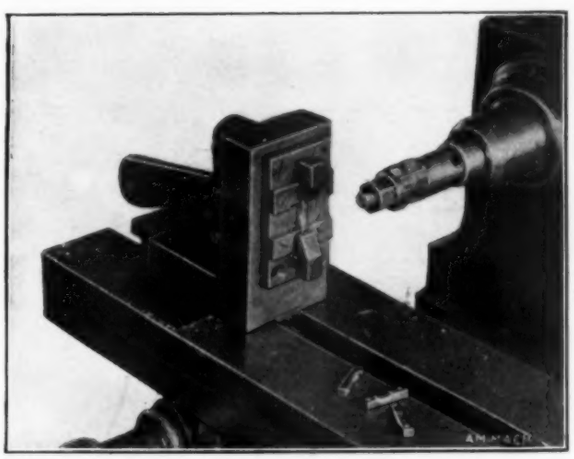


Fig. 22. Milling Feed Nuts

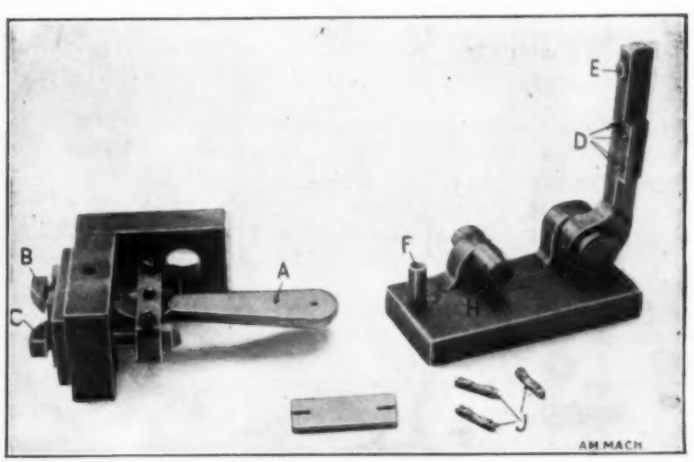


Fig. 23. Milling Fixture and Radius Gage

The time taken to cut a feed screw for the Home model averages about 14 minutes. After they are cut to size they are put in a small bench lathe as shown in Fig. 21, and the thread is chased and polished by hand, using a hardened and fluted half-nut like the one at *A*.

FIG. 24. FEED NUT FIXTURE OPEN

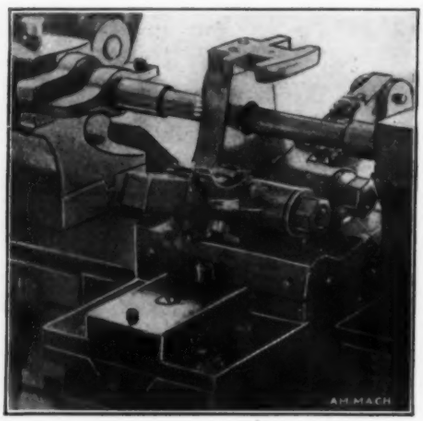


FIG. 25. NUTS AND CLAMPS IN PLACE

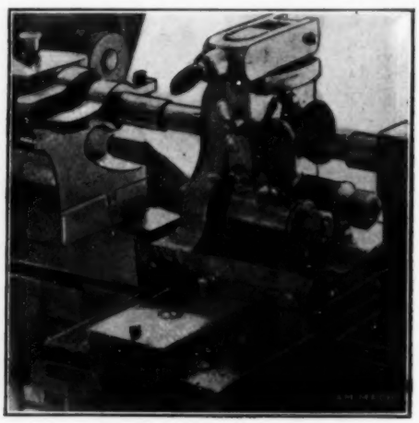


FIG. 26. FIXTURE READY FOR HOBBING

MAKING FEED NUTS

Feed nuts are all made in practically the same way, those for the Home model being ¾ in. in length, cut from bars of steel $\frac{7}{8}$ in. square. They are placed in a jig and a hole drilled through each end, a radius is then milled in them, each edge of the radius being chamfered, the whole thing being done at once with a formed milling cutter while the feed-nut blank is held as shown in Fig. 22.

The fixture used to hold the blank is more clearly shown at the left in Fig. 23; *A* being an eccentric lever which operates the two clamps *B* and *C*, the blank being located over dowel pins between steel guide-pieces.

TESTING THE RADIUS

The milled radius is tested in the gage shown at the right in this halftone. Two blanks are set over the dowel pins *D* and the swinging arm is brought down until the stop *E* strikes the pin *F*, when the milled radius of each piece should fit the surface of the plug *H*. A number of feed-nut blanks with the radius and chamfer milled in them is shown at *J*.

HOBBING THE THREADS

The threads are cut in four feed nuts at once at the rate of about four minutes for the set, or one minute each, and are held in a special fixture in a Sloan & Chace bench lathe shown in Fig. 24, and fed along the hob A.

Two pieces are set over the dowel pins *B* in the arm *C* and two over similar dowel pins in arm *D*, then clamping pieces are slipped into place as shown in Fig. 25 and the thumb-screws tightened; next the arms are swung up and locked in place, as shown in Fig. 26, and the nuts are ready for hobbing.

Truing a Crankshaft

The halftone shows a repair job recently done on a 60-in. lathe in the shops of the Waterbury Farrel Foundry, Waterbury, Conn.

The shaft is a double-disk crank about 12 in. in diameter, and 10 or 12 ft. between the disks. The pins are 7½ in. in diameter and 8 in. long.

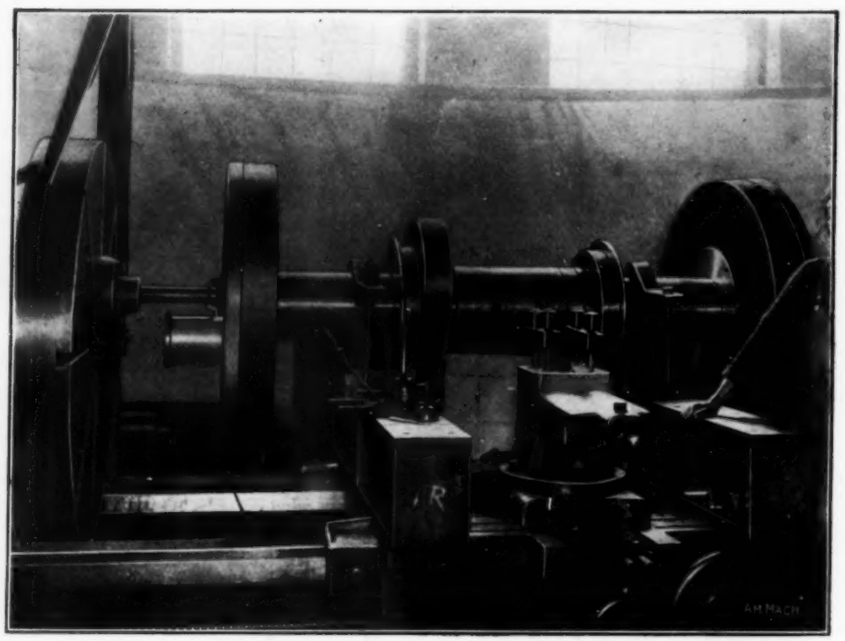
In use it was found that the shaft was out of truth, owing to the way it had been made. The shaft and the pin holes in the disk had been bored true and parallel with each other, but after the shaft had been keyed up, the stress placed on the disk by the key threw it out of square with the shaft about $\frac{1}{32}$ in. at the periphery. This naturally threw the pin out of parallel with the shaft. The error was not discovered until the engine gave trouble.

The shaft was then taken out and sent to the foundry to be trued up. It was first placed on centers and the face of each disk turned true with the shaft.

It was at first intended to drive out the old pins and put in new ones, but Frank Loyot, who runs the big lathe, pointed out that the insertion of new pins in the old holes would not correct the trouble and suggested turning the old pins true in place with the rig shown in the halftone.

The shaft was laid in V-blocks and the face of the trued disk set parallel with the faceplate of the lathe.

The first setting took about a day, and the second setting, owing to experience gained in the first setting, was done in half a day. The time for doing the actual turning on the pin was about 2 hours. After turning, the pins were polished by a similar rig, but a piece of wood was substituted for the cutting tool, and a piece of emery cloth was placed between it and the pin.



TRUING UP A CRANKSHAFT IN A 60-IN. LATHE

The Machining of Railway Motors—I

By C. B. Auel *

Some of the more important mechanical features involved in the manufacture of these. Details of the machining operations on the fields.

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The evolution of the modern street car from the unsanitary and unsatisfactory horse-drawn vehicle of some years ago to the sanitary and palatial all-steel, electrically operated conveyance of today, remarkable as it has been, is no more so than the development of the electric motors which propel it. The truth of this statement will be the better appreciated and the magnitude of the problem already solved by electrical engineers will be the more readily grasped, when it is realized that 20 years ago horsecars were much more numerous than electric vehicles, that the average weight of cars has during this period increased approximately 400 per cent., that speeds have about trebled, while distances hauled for the same fare have probably doubled.

Since the space under a car for the placing of the motors has remained almost constant, being limited by the gage of track and the height of car floor, it has been necessary to resort to the highest grade and strength of materials, in order to use to the best advantage the room available. Cast iron has in consequence, largely given way to malleable iron or to cast steel; bearing linings with a lead base have been replaced either by tin-base linings or by bronze bearings; copper of rectangular section instead of round, is almost universal both for field and for armature coils, and so on. Further improvement would seem of necessity to be in the matter of details rather than in any radical changes in design, except possibly where special operating conditions exist and demand special features.

As may be inferred from the title, it is not the intention here to enter into a complete description of the construction of modern railway motors; but, rather to describe some of the more important mechanical features involved in their manufacture.

FIG. 1. THE SPLIT-FRAME MOTOR

The so called street-car or medium-size railway motor may be either solid or box, and split. In the former the frame is of a single casting, while in the latter, the frame is of two castings, split usually on the horizontal line, as shown in Fig.1, though occasionally it may be split on a diagonal. As the two types do not differ radically from each other in their machining operations, a description of the methods employed in the one case, will in a large measure, apply to the other. In what follows, however, particular reference will be made to the horizontally split motor.

UPPER AND LOWER HALF FIELDS

Milling or Planing—The castings upon arrival at the works are inspected in the rough; and, if satisfactory—that is, neither warped nor twisted and apparently sound—are either milled or planed. While there are advocates of each of these operations, there is in reality little to choose between them, at least as far as the finished product is concerned.

If the design is a standard and the making of milling cutters as well as jigs for holding the castings, is warranted by the quantity, then milling will undoubtedly be the cheaper since it is much the quicker after the mills have been set for the work. If, on the other hand, but two or three motors are involved, no matter whether they are of special design, or whether the design has once been a standard and cutters and jigs are accordingly at hand, planing is to be preferred, if for no other reason than that less time is required to rig the machine. Planing is also preferable where the castings are variable in quality and in the amount of material to be removed, since the breaking of a milling cutter is a much more serious matter than that of a single planer tool.

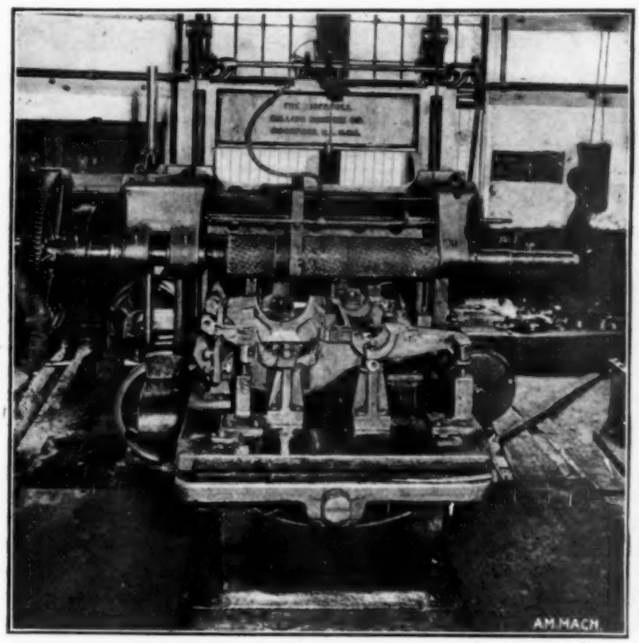


FIG. 2. A MILLING OPERATION

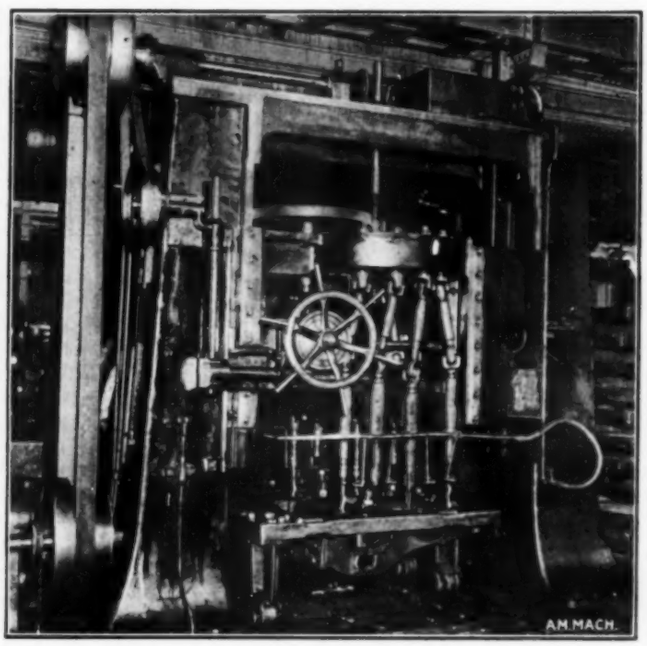


FIG. 3. A PECULIAR DESIGN OF JIG

When milling, the cutter is almost always supported in the middle by a bearing, as illustrated in Fig. 2; otherwise the cutter would not make a level cut, springing away from the casting when milling the ends where there is the most material to be removed. To safeguard further against the tendency just mentioned, the milling cutter is made to taper slightly from the center toward both ends. In addition, two cuts are taken over the entire face of the casting, the cutter being speeded up while passing over the center portion.

As a result of these precautions, the two half castings (upper and lower) when bolted together later on in the course of assembling, fit very closely throughout their entire area of contact, the clearance never being permitted to exceed 0.008 inch. The necessity for so much care being exercised in this matter, is not only to prevent the entrance of rainwater when the motor is in running position under the car; but, also to adhere to the speeds for which the motor was designed, any air gap above normal tending to increase these. At the conclusion of the milling operation, sufficient material should have been removed, so that when later on, the halves of the motor are bolted together and bored, the poles will be faced off smooth and no rough places left on them.

Drilling of Parting-Line Bolt Holes—After the upper and lower castings have been milled, the holes for the bolts by which these, as well as the axle caps, are bolted together, are drilled. In order to insure inchangeability of parts, jigs must always be used and care must be taken to see that the holes are laid out properly with respect both to the poles in the direction of their length, and to the armature and axle bores.

The holes are drilled $\frac{1}{32}$ in. larger than the diameter of the bolt, to prevent binding. Fig. 3 shows a casting in the process of drilling, and it is of interest to note the peculiar design of jig, which consists of a flat plate mounted on wheels, the casting being bolted to the underside. Almost no time elapses between the drilling of consecutive castings, for the jigs are in duplicate, and a second casting is always bolted to the second jig while the first casting is being drilled.

Spot Facing of Parting-Line Bolt Holes—After the holes have been drilled for the parting-line bolts, they are "spot faced;" that is, the casting in the vicinity of the holes and on the side away from the milled or planed surface, is smoothed off with a counterbore, thus permitting the bolt heads to lie perfectly flat against the casting and not at one or two points only. To insure that such is actually the case, the bolts are further provided with a specially finished round collar directly under the head, so that even though the bolt may have received a blow and the head in consequence be bent over at one or more corners, solidity of contact is still assured.

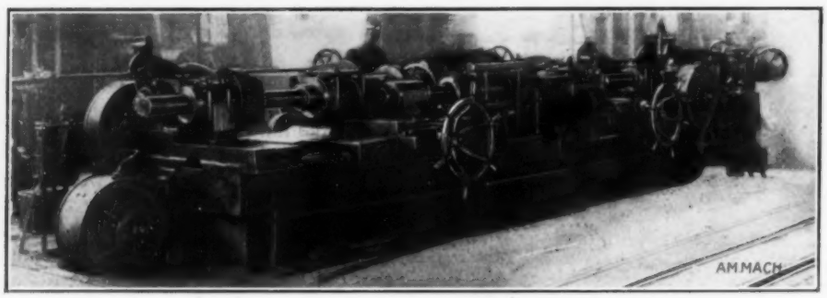


FIG. 4. BOTH BORES ARE DONE AT THE SAME TIME

Laying Out Fields—Both the upper and lower castings, or the half fields as they are sometimes called, are now ready for what is known as laying out for the armature and axle bores. Each casting is placed upon a table, after which an expert mechanic with the aid of templates and straight-edges, and with the parting-line bolt holes as a guide, lays off the location of both the bores. In so doing, the utmost care is required to see that there is enough material in the castings, so that in the actual boring, both bores will cut clean and without leaving any rough spots.

At the same time, it must also be observed that too much material is not cut away; otherwise, in the armature bore the poles may be left of insufficient depth to support the field coils, while the axle bore may prove to be lacking in the requisite thickness for the magnetic circuit, thus having the same tendency as mentioned under "Milling or Planing." to cause the motor to run at speeds that are too high.

Milling and Drilling of the Axle Caps—The axle caps which may both be of cast steel, or which may be one of cast steel and one of malleable iron, are tested for porosity as soon as received. This is accomplished by placing them in a suitable position varying with their shape, filling with kerosene or carbon oil and allowing them to stand for at least one hour. Any sweating is readily corrected either by hot galvanizing, or by flashing with the electric arc.

Hot galvanizing will not of itself fill any distinct holes, but it will in such cases, serve as a backing and any holes can then easily be soldered. The castings when repaired, are tested for leaks as before; and, if then found sound are milled, the holes for the bolts drilled and spot faced in a manner similar to the holes in the half fields, previously described.

Armature and Axle Bores—The half fields (upper and lower) and a set of axle caps are next assembled, shims about 0.012 in. thick being placed between the parts, for the purpose of securing a clamping fit on the axle bearings and the armature housings (which latter contain the armature bearings) when the motor is put together in its final form. Both bores are done at the same time, special horizontal mills, Fig. 4, having four independent spindles, and driven by independent variable-speed motors being used. In this way the axle bore which is longer, though of smaller diameter than the armature housing bore, can be put through in approximately the same length of time. As a part of this same operation, the ends of the castings are faced off in order that both housings and axle bearings may, in the final assembly of the motor, fit snugly against the frame and thus keep the motor to the correct overall dimensions axially.

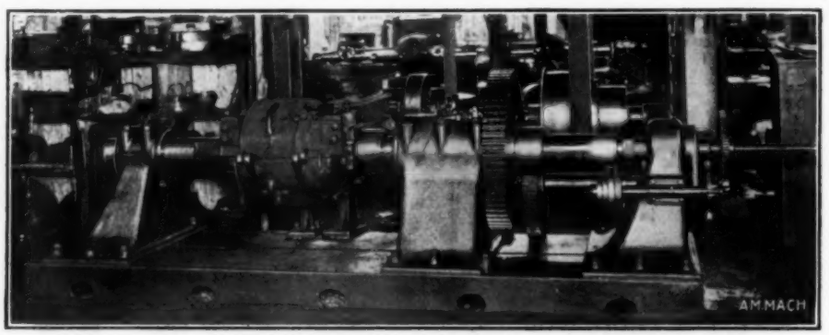


FIG. 5. ONE OF THE BORING OPERATIONS

Pin gages are employed to test the accuracy of the bores. Each bore is made so that a pin gage of the required diam-

eter will, when placed within it, either be a tight fit or will have a pendulum motion about one of its ends as a center, not to exceed a predetermined allowance, depending upon the size of the bore. For example: An axle bore of 8 in. would be permitted a rocking movement of not over 3/8 in., this corresponding to an allowance of 0.002 in.; an armature housing bore of 18 in. would similarly be permitted a movement of the same amount (3/8 in.), which on this diameter, corresponds to an allowance of 0.001 in. In overall lengths, rather more latitude is permitted in the variation from exact dimensions, 1/64 in. either way being allowed.

Miscellaneous Machining of the Axle Caps—After the boring operation just described, the axle caps are removed and drilled for the oil-box cover, and the keyway for the bearing is also milled or slotted; or, when a key is not used, the axle caps are drilled for a dowel pin.

Field Bore—The next operation is that of boring the field, sometimes called boring for the armature. In order to do this, it is necessary to have a set of dummy housings with bearings in them, so that the motor frame may be held centrally on the boring bar. When the motor is in service, the armature bearings will in time, wear away slightly in a downward direction; to compensate for such wear, it is the usual practice to elevate the armature itself 1/32 in. above the true center. This may be accomplished in either of two ways. The dummy housings may be machined off center so that the bearings in them come 1/32 in. below the true center, thus bringing the boring bar a similar distance below the center and causing it to bore the field in the same way; or, the motor may be bored exactly true and the offset made in the armature housings (not the dummy housings) that form part of each finished motor. The former of the two methods is, however, the one more generally used, Fig. 5.

Milling the Gear Case Pads—In the milling of the gear-case pads, Fig. 6, it is of the utmost importance to have the pads of such thickness that the gear case will fit snugly on them, so that when the motor is in service, wear with its rattling of parts will be avoided. An allowance not to exceed 0.010 in. is permissible either way from the exact dimension.

Suspension Pads—The suspension pads may, like the half fields, be either milled or planed, Fig. 7. The proper distance both horizontally and vertically from the center line of the armature shaft must be maintained, 1/8 in. being, however, considered sufficiently accurate for these dimensions. The faces of the pads must at the same time be parallel with a vertical plane through the same line.

Miscellaneous Drilling—In addition to the drilling already described, there is a miscellaneous lot of drilling to be done, which is arbitrarily divided into three classes: (1) drilling and counterboring the holes for the pole-piece bolts and the housing bolts, the motor being revolved about a bar passed through it axially; (2) drilling miscellaneous holes with the motor inclined nearly horizontal; (3) drilling miscellaneous holes with the motor nearly vertical. This miscellaneous drilling includes holes for the cable bushings, cable cleats, inspection-hole covers, hand-hole covers and oil-box hinge holes.

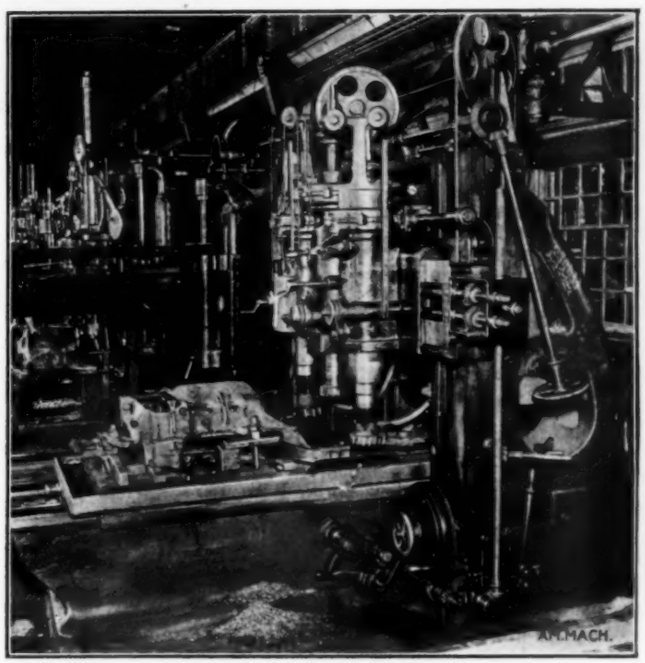


FIG. 6. MILLING THE GEAR-CASE PADS

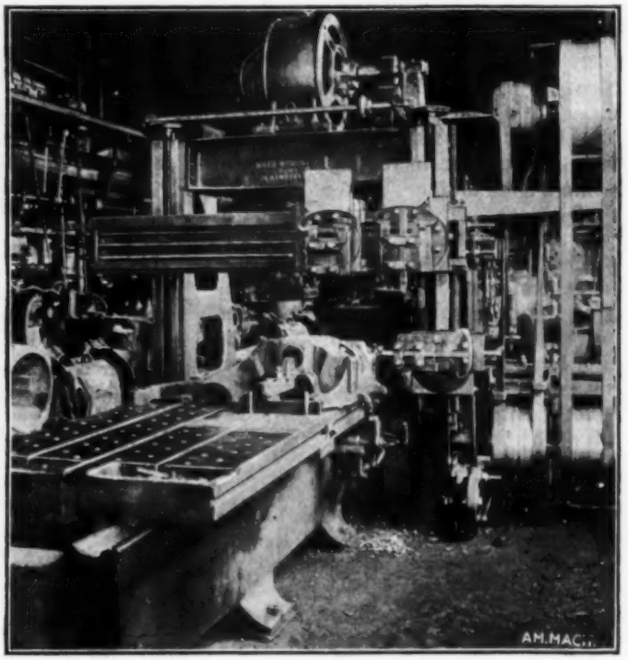


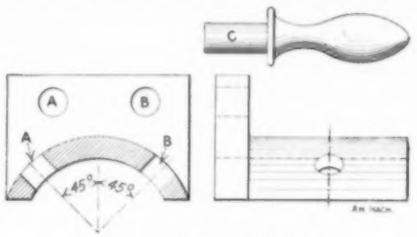
FIG. 7. PLANING THE SUSPENSION PADS

Difficult Cored Holes

BY E. W. TATE

Receiving an order for a number of castings, in which the holes *A B* were to be cored, the method illustrated was used to core them. The pattern, which was only a sample casting, was molded as if there were no holes in it.

After the cope was lifted, and before the pattern was removed from the mold, the end *C* was forced through the holes



DIFFICULT CORED HOLES

A B to form a print for the core, the end *C* being long enough to make a suitable coreprint, the length *C* determining the length of the core. This method was used to avoid loose prints.

The only gas produced from crude oil up to within a very recent period, has been one having a value from 550 to 680 B.t.u. per cu.ft., used for domestic lighting and cooking. This gas has been produced by the process known as the "cracking" of the crude oils, which is largely disruptive in effect and frees a very large percentage of hydrogen and carbon, resulting in a gas carrying 50 per cent. and upward of free hydrogen. This gas will give no higher efficiency in a gas engine than distillate.

Selection of Motors and Flywheels

By C. R. Riker*
and S. A. Fletcher†

Most of the discussions that have been written regarding the interaction of motors and flywheels have employed formulas involving the difficult use of logarithms to evaluate properly the different variables. With this situation in mind the writers of the present article have worked out a series of curves by means of which the constants for any ordinary flywheel can be determined without recourse to a single calculation.

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The function of flywheels in storing energy during periods of light load and delivering a part of this stored energy during periods of heavy load has been well understood for a long time. But in many cases full advantage has not been taken of the benefits of flywheels because their exact action has not been fully known. Flywheels in recent years have been utilized increasingly either to secure a more uniform speed or to reduce the fluctuations in the power required to drive some machine.

This increasing use is partially due to the general trend toward improved apparatus, but more so to the adoption of the individual electric motor drive as the form of power supply. Motor drive permits accurate measurements of power and correct analyses of the momentary action of the flywheel, which are impossible with mechanical systems of power distribution.

The customary use of a flywheel to reduce speed fluctuations in steam and gas engines will not be discussed in this article which is confined to two other uses of flywheels: First, directly connected to the driven machine and serving to carry it through an operation or cycle of operations, the motor being used mainly to bring the flywheel back to its original speed. Second, connected to a motor which drives only the flywheel and acts alternately as a motor bringing the flywheel back to normal speed during light load, and then as a generator delivering power to the electrical circuit when the demand for power is heavy.

As an example of the first class may be cited the large flywheels used in steel mills, or smaller wheels with the ordinary punch or shear. The second class is used largely in connection with ore docks and mining installations, where there is a rapidly fluctuating load. In these cases the generating-apparatus and the transmission-line capacities may be materially reduced by the use of a suitable flywheel. Both classes are exemplified at once in the flywheels used in connection with the well known Ilgner system of mine hoists, or its American modification, the Westinghouse system. Here the flywheel carries part of the load, and at the same time stores sufficient energy to operate the hoist for one or more complete trips after the power has been entirely disconnected.

To properly select a flywheel for a given load or a motor to drive a given flywheel on a given load the momentary relations between the torque required by the load, the torque supplied by the flywheel and that supplied by the motor must be fully analyzed.

Logarithms Eliminated

Much has been written regarding the interaction of motors and flywheels and the results that may be hoped for when due regard has been given to the characteristics of both, but most such discussions involve the use of formulas which contain a logarithmic term to the base of the Naperian system*. or else deal in average terms only, and are of no value for determining momentary or maximum loads on the motor.

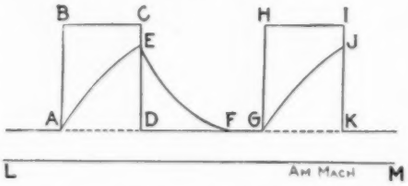


Fig. 1. Chart of a Typical Load

Such terms can be handled satisfactorily with the aid of a table of Naperian logarithms which require some little experience in their use in order to evaluate properly the different variables. With this situation in mind a series of curves has been worked out by the aid of which the constants for any ordinary flywheel may be determined without necessity for a single calculation. A second series of curves has been worked out which permits the action of any given motor and flywheel on a given load to be accurately determined with the minimum of labor and time.

For proper results the motor on a given flywheel load must have characteristics somewhat different from those of the usual standard motors, because the benefit of the flywheel comes only with a change in speed, whereas the ordinary motor has a speed regulation that involves but a small percentage change in speed from no load to full load. Hence, the motor for a flywheel must have a much larger drop in speed from no load to full load than the ordinary motor. Otherwise, the motor will try to do all the work and will allow the flywheel to drop its speed but little, and hence will nullify the benefit that might be derived. It has been found that it is economical to use compound-wound, direct-current motors with a speed regulation as high as 35 per cent. though it is seldom that it runs quite as high, 25 per cent. being a very fair value. With alternating-current induction motors of either the squirrel-cage or the wound secondary types with fixed running resistance, the speed regulation or slip, as it is called, in induction motors, should not exceed 20 per cent.

A Type of the Load Considered

A typical load plotted in terms of the torque as ordinates, and time as abscissas is shown in Chart 1. The torque developed by the motor follows the line *AE* to *EF* while the flywheel torque follows the line *AB* to *BC* to *CE*, and at *F* the flywheel has come back to its initial speed and the load on the motor has dropped to that required to overcome friction. At *G* the load comes on again and the cycle of operation is repeated as at *ABC*, etc. The distance between the reference lines *LM* and *AK* shows the friction torque. In the period from *E* to *F* the motor is accelerating the flywheel.

It is possible to design automatic controllers for phase-wound induction motors which will hold the load on the motor practically constant for whatever cycle the design was originally made. This is done by varying the secondary resistance. Such cases will not be considered, as they are special problems confined almost exclusively to very large mining work where the practice is very different from that under discussion.

The Formulas Employed

Various formulas may be used in determining flywheel effect, etc., but the ordinary one involves the use of the term horsepower-seconds and is obtained from the well known formula for the energy stored in a moving body.

$$E = \tfrac{1}{2}MV^2 \qquad (1)$$

In the equations in this article, the notation will be as follows:

Let

E = Energy in the flywheel,
M = Mass of the flywheel,
W = Weight of the flywheel,
V = Velocity of flywheel at the center of gyration in feet per second,
V_1 = Initial velocity of flywheel at the center of gyration in feet per second,
V_2 = Final velocity of flywheel at the center of gyration in feet per second,

*See Proceedings, American Institute of Electrical Engineers, June, 1909, paper by H. C. Specht.

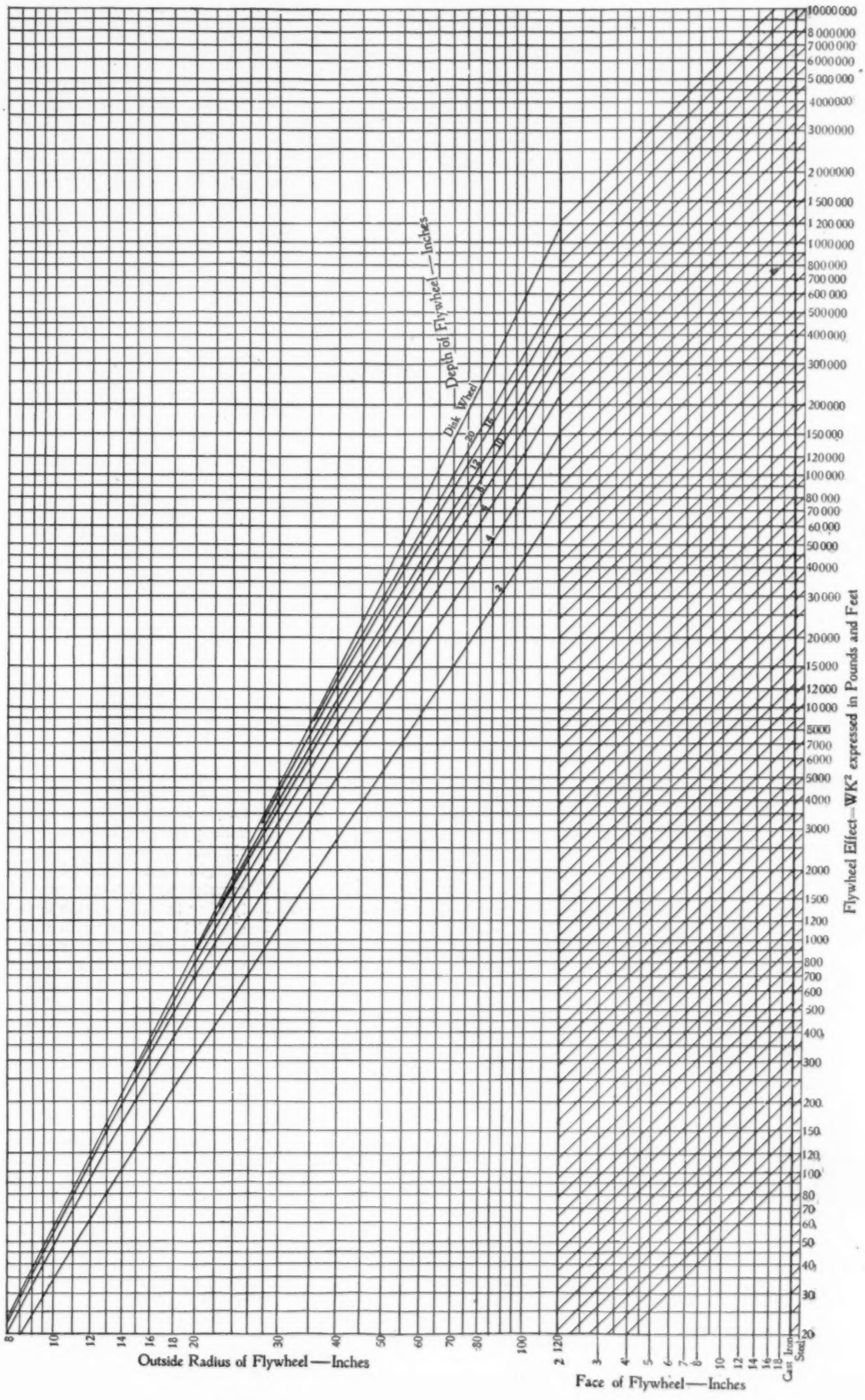


FIG. 2. CHART FOR DETERMINING THE CONSTANT WK^2 OF THE FLYWHEEL

K = Radius of gyration in feet,
R = Outside radius of flywheel expressed in feet,
r = Inside radius of flywheel expressed in feet,
$d = R - r$ (expressed in inches),
f = Face of rim of flywheel in inches,
N = Revolutions per minute,
N_1 = Initial speed in revolutions per minute,
N_2 = Final speed in revolutions per minute,
T = Maximum torque of the load at one foot radius and at the flywheel speed,
T_1 = Average torque at one foot radius developed by the flywheel,
t = Time in seconds during which change occurs,
S = Revolutions per minute drop in speed if the motor carried the entire load without the assistance of the flywheel.

From the fundamental formula (1) is derived the formula:

$$Horsepower\text{-}seconds = \frac{W \times V^2}{35{,}420} \quad (2)$$

This is the total energy stored in the flywheel and a portion will be delivered according to the speed drop, thus,

$$Horsepower\text{-}seconds = \frac{W\,(V_1^2 - V_2^2)}{35{,}420} \quad (3)$$

The dimensions of the flywheel determine the values of V_1 and V_2 and are referred to the center of gyration which may be found for a disk flywheel from the equation

$$K^2 = \tfrac{1}{2}\,R^2 \quad (4)$$

For a flywheel having a rim and a web the effects of each must be calculated separately and then added, thus:
For rim

$$K^2 = \tfrac{1}{2}(R^2 + r^2) \quad (5)$$

For web

$$K^2 = \tfrac{1}{2}r^2 \quad (6)$$

For spokes approximately

$$K^2 = \tfrac{1}{3}r^2.$$

The value of V in terms of K and N is readily determined, and is given here as V^2 since it is used to the second power thus:

$$V^2 = \left(\frac{2\pi KN}{60}\right)^2 = 0.0110\,K^2N^2 \quad (7)$$

This reduces the formula for the energy given up by a given drop in speed to the expression

$$Horsepower\text{-}seconds = WK^2\,(N_1^2 - N_2^2) \times 0.000\,000\,311\,5 \quad (8)$$

From (8) the following formula may be derived, involving torque instead of horsepower, remembering that the average speed and average torque must be used

$$T_1 = \frac{0.00326\,WK^2\,(N_1 - N_2)}{t} \quad (9)$$

The weight W may be figured from the volume of the flywheel, or it may be determined in any other way desired.

Determining the Radius of Gyration

With some designers it has been customary to figure the volume of the rim from which its weight is determined and then to this weight a certain percentage is added according to the size of the flywheel, to allow for the extra weight in the arms and the hub of arm-and-rim flywheels. While this method is entirely correct for the determination of the weight, it is necessary under these conditions to consider the radius of gyration of the entire flywheel, and this cannot be calculated readily.

It is preferable to consider the weight of the rim only and the radius of gyration of the rim only. If it is found desirable to make a correction, from 7½ to 10 per cent. can be added to the flywheel effect found in this way to allow for the action of the arms. It will be noted that the value of K^2 for the arms is approximately $K^2 = \tfrac{1}{3}r^2$ while for the rim where R is only slightly greater than r, $K^2 = r^2$.

Furthermore, the greater part of the weight of the arms is in the hub, so that if the hub and arms weigh as a maximum 35 per cent. of the rim, the maximum value of WK^2 for the arms will be approximately 10 per cent. of WK^2 for the rim. With slender arms and large hub the effective weight is much nearer the center and WK^2 would be less. In the following discussion no allowance has been made for the arms, and the rim only has been considered. This does not, however, affect the accuracy of the curves presented, since an allowance may be made as mentioned above after the values of WK^2 are determined from the chart. This matter must of necessity be left to the individual cases because of the variety of types of flywheels.

It has been customary to calculate the total energy in the flywheel and then to determine what percentage will be delivered with a given drop in speed. This available energy is then divided by the time during which the drop occurred and the result is the average horsepower (provided the energy has been expressed in horsepower-seconds, as is customary) expended during the time.

This gives no notion as to the maximum load on the motor, and hence does not permit of a satisfactory solution of the problem, unless a large margin is allowed for safety, which is not actually solving the problem, but merely making a fair guess. It has, however, been found possible to deal with this problem in terms of torque and to evaluate the actual maximum motor load by means of a series of curves.

The Fundamental Assumptions

The curves are based on the formulas developed in the excellent paper, "Action of Flywheels in Connection with Electrically Operated Rolling Mills," by H. C. Specht, and published in the "Transactions of the American Institute of Electric Engineers" for June, 1909, page 869. It is to be noted that the fundamental assumption is that the torque of the motor is inversely proportional to the speed; that is, that the speed torque curve of the motor is a straight line. This will be an actual fact within the working range of the motor. It would not be true should the motor carry the entire load, as is assumed in the course of the investigation.

However, it is pure assumption only that the motor carries the entire load, and the fact that the motor torque would not actually correspond to the speed under these conditions, does not affect the accuracy of the solution in any way, hence, these curves may be used for both alternating- and direct-current motors, and will give results more accurate than the data which may be available for any specific case.

The Preliminary Determinations

Before any study can be made of the actions of the flywheel, it is necessary to determine in detail the actual load that is to be carried by the combined action of the flywheel and motor. This may be obtained from machines built previously and operating under similar conditions, or it may be obtained by calculation when the machine is being designed. In any event, the maximum work to be performed must be known and the load determined in terms of the torque at one foot radius at the flywheel speed.

In case it is desired to determine the torque from a machine already equipped with a flywheel but driven from a mechanical system, the machine should be brought up to full-load speed and one complete operation performed immediately after throwing off the belt. The work should be the maximum which will normally be performed on the machine. This will cause the flywheel to drop in speed in order to deliver the required energy. This drop in speed may be read with a tachometer, provided the time is not too rapid.

The time itself should be read with a stop watch or by determining the portion of a complete revolution during which the action takes place, and then figured from the revolutions per minute. The dimensions of the flywheel must also be determined. From Fig. 2, which will be explained later, the constant of the flywheel, namely, the product of the weight and the square of the radius of gyration, may be determined directly and then the torque may be determined from formula (9).

The object to be obtained is a fairly even load on the motor with the peak not greatly in excess of the rated motor capacity, and an average load on the motor

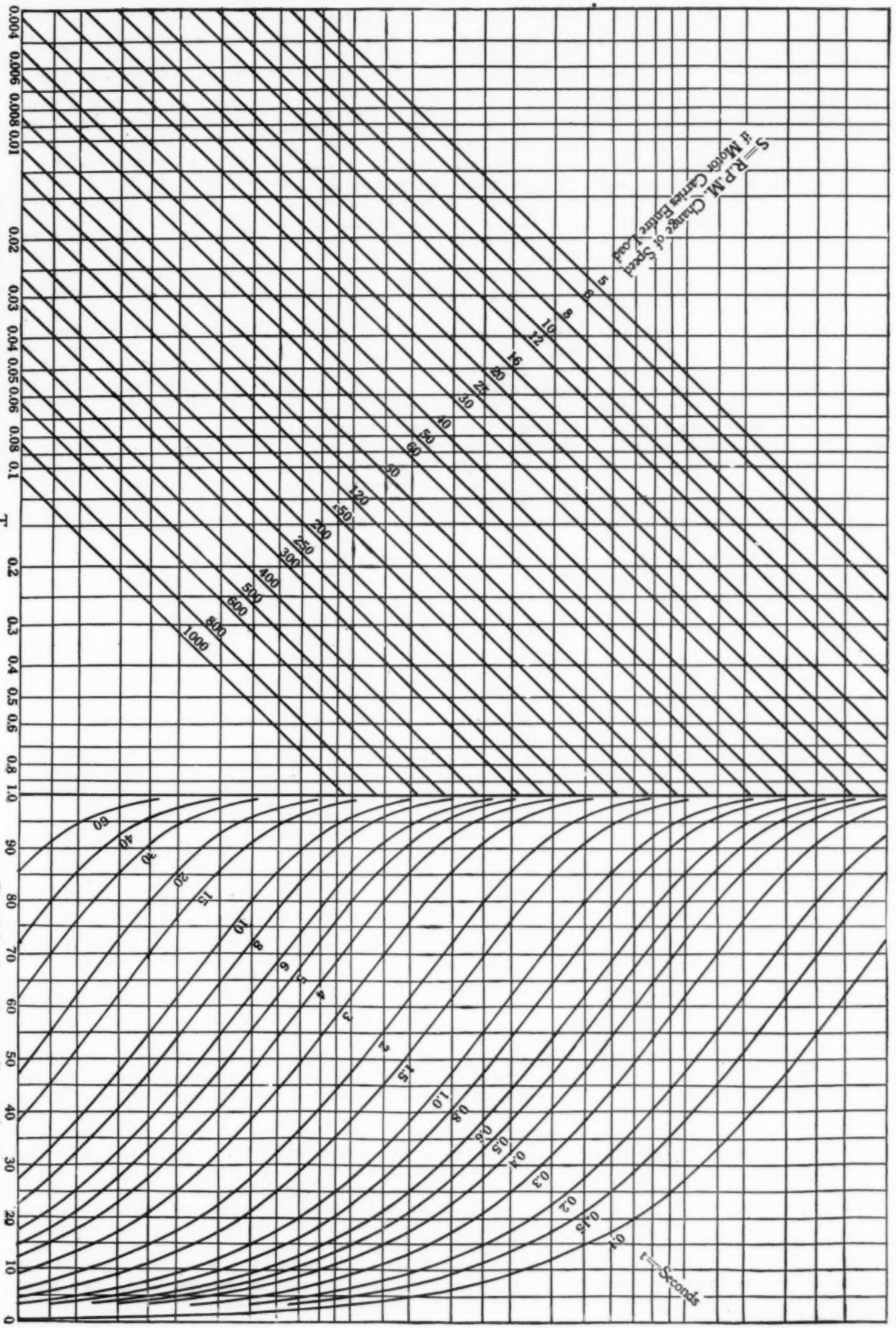

S=R.P.M. Change of Speed if Motor Carries Entire Load
t=Seconds
Ratio of Torque of Load to Flywheel Effect = T/WK²
Drop below Initial Speed in Percent of "S"

FIG. 3. CHART FOR DETERMINING THE SPEED DROP

as high as possible without overload. This requires a consideration of the starting torque, the maximum load on the motor while running, the time for acceleration between the peaks and the time in which the drop in speed occurs. It will be found that the load on the motor must of necessity vary, and if time is allowed between the peaks, the load will drop to the friction load of the machine, from which it will rise to its maximum and then fall off. This is the action of the motor for the usual machine tools where the work is of an intermittent nature, as in punches, shears, presses and other similar machines.

The chart, Fig. 2, is used in determining the flywheel effect of the flywheel, and will be found to cover flywheels of either cast iron or steel, from 8- to 120-in. radius with rim from 2 in. to 20 in. thick, and with face from 2 to 20 in. The chart gives flywheel effect, that is, WK^2 directly, the final value being expressed in the product of the weight W in pounds, and the square of the radius of gyration expressed in feet.

The chart, Fig. 3, is used in determining the actual load, which will be carried by a given motor with definite speed regulation when operating on a known load with a given flywheel, Fig. 2 being preliminary to Fig. 3 for the determination of the constant of the flywheel; namely, WK^2.

Using the Charts

The method of using the charts is dependent upon the fact that the speed and the torque of a given motor have a very definite relation, so that when one is known the other is determined also, and hence the motor load is also known immediately. Thus, if a motor, whose speed drop is 20 per cent. from no load to full load, carries a load causing a drop of 10 per cent., it is known at once that this must be one-half of the full load, since the speed drop is in direct proportion to the increase in the load. Briefly, the method of solution is this:

First, the flywheel effect is found from the dimensions of the flywheel by the use of Fig. 2, then from some source is determined the maximum load to be carried by the motor and flywheel combined. After this is determined what the speed drop would be if the motor actually carried this maximum load without the assistance of the flywheel. Then from Fig. 3 is determined the actual speed drop that will occur with the motor and flywheel acting in conjunction. From this value the percentage drop is determined and added to the drop due to friction and the full motor speed drop from no load to maximum load is known, and by comparison with the speed regulation of the motor, the actual maximum load on the motor is accurately known. This is best explained by the solution of a problem.

Problem: To find the flywheel effect of a cast-iron flywheel with a 40-in. radius and the rim 8 in. thick, and a 10-in. face. This means that $R = 40$; $d = 8$; $f = 10$. Start in Fig. 2 with the value $R = 40$. Follow to the curve marked $d = 8$, and from this point follow at right angles to the heavy reference line below, and from this point follow a 45-deg. line until the proper width, 10, is reached. From this point trace at right angles to the reference line down to the reference line "Cast iron," where the value of WK^2 may be read directly. In this case it is 43,000.

At the bottom will be found two reference lines marked, respectively, "Cast iron" and "Steel." If the flywheel is of cast iron, the value of WK^2 should be read at the reference line marked "Cast iron," while if of steel the vertical lines should be followed as far as the reference line "Cast iron," and then a 45-deg. line followed to the "Steel" reference line, where the value of WK^2 will be read.

The use of Fig. 2 is preliminary to the use of Fig. 3, from which the flywheel action may be determined. The maximum torque of the load above friction is already known, as well as the torque required to overcome friction, having been previously determined by some method. In all cases the torque is referred to the flywheel speed and is at one-foot radius. Having determined the torque T, and the value WK^2, Fig. 3, may be used, as explained in the following problem, which is a continuation of the previous problem.

A Problem and Its Solution

Problem: With the previous flywheel operating on a load having a maximum torque of 4300 lb. above friction and a friction load requiring 650 lb. torque, what would be the proper size of motor to use if the load lasts for two seconds, and the interval between peaks is 30 sec?

The flywheel is to be run with a peripheral speed of 6000 ft. per min. at the highest speed during the intervals between the peaks. Alternating current at 60 cycles is available. What speed drop should be used and what will the maximum load on the motor be?

From Fig. 2, WK^2 has been determined, therefore the ratio $\frac{T}{WK^2}$ is determined at once and is equal to 0.1. A speed of 6000 ft. per min. on a 40-in. flywheel requires a speed of 286 r.p.m. As a preliminary estimate, 20 per cent. slip will be assumed, since this is about as large a slip as is advisable with squirrel-cage induction motors or induction motors having a constant-operating secondary resistance. Some idea of the size of motor to be used may be gained from the horsepower of the friction load. The power required to overcome friction is found from the friction torque and the well known formula for horsepower and torque:

$$Hp. = \frac{T \times r.p.m.}{5250} \qquad (10)$$

hence, the friction horsepower is

$$\frac{650 \times 286}{5250} = 35.4$$

As a starting point a 100-hp. motor will be considered, since a friction load of about one-third the motor rating is a very reasonable assumption. Consider first a 10-pole motor having a synchronous speed of 720 r.p.m., which, with 20 per cent. slip at full load, means a speed of 576 r.p.m. The friction load is 35.4 per cent. of the full load and hence the drop in speed from no load on the motor (720 r.p.m.) to 35.4 per cent. load will be just 35.4 per cent. of the full drop, or 35.4 per cent. of 144 r.p.m., which is 51 r.p.m. Hence, the motor speed at friction load is 720 — 51 = 669 r.p.m.

The full-load torque of the motor at the motor full-load speed is found from (10), thus

$$Motor\ torque = \frac{100 \times 5250}{576}$$

But this is the torque at the motor speed, and is, therefore, less than at the flywheel speed in the ratio of the flywheel speed to motor speed. This ratio is evidently found from the motor and flywheel speeds at friction; these are, respectively, 286 and 669, so that the full-load torque of the motor at flywheel speed is:

$$\frac{100 \times 5250 \times 669}{576 \times 286} = 2125\ lb.$$

The maximum load above friction is 4300 lb., and which is, therefore, a load above friction of

$$\frac{4300}{2125} = 202.5\ per\ cent.$$

As 100 per cent. load causes a 20 per cent. drop, 202.5 per cent. load will cause 40.5 per cent. drop, which represents 115.8 r.p.m. of the flywheel.

Curve 3 may now be employed. The value of $\frac{T}{WK^2}$ is known to be 0.1 from the conditions of the problem, and S, the speed drop in revolutions per minute if the motor carried the entire load, has just been found above to be 116.2. The time is also known, as two seconds. The chart is entered with the value $\frac{T}{WK^2} = 0.1$ at the bottom. This value is followed till the sloping line $S = 115.8$ is crossed. As the nearest values are 100 and 120, it is necessary to interpolate. From this point, where the imaginary line $S = 116.2$ crosses the line 0.1, follow a horizontal line till it crosses the curve marked $t = 2$ seconds. Then from this intersection follow a vertical line to the bottom of the chart, where a per cent. may be read, in this case 42 per cent. This is the drop below the initial speed in per cent. of S, which actually takes place with the flywheel assisting the motor.

Hence, as S was 40.5 per cent., the actual drop will be 42 per cent. of 40.5 per cent., or 17.01 per cent. drop in the motor or flywheel speed below friction speed. The drop due to friction load is 7.08 per cent., making a total drop of 17.01 + 7.08, or 24.1 per cent. Therefore, the maximum load on the motor will be $\frac{24.1}{20} = 120$ per cent. load.

In reading the final results of percentage drop on the base line in Fig. 3, it should be noted that here the abscissas are not plotted to the logarithmic scale, but are plotted to straight coördinates. This was done to make the curve readable over a wider range, and is mentioned only to prevent errors in reading the final result. All other coördinates are plotted to logarithmic scales.

The time interval between the peaks is 30 sec., and it is necessary to determine whether the motor is capable of bringing the speed of the flywheel back to normal. To determine what the motor does in bringing the speed back, Fig. 3 may be used again, but with different values of T, S and t.

The torque is T, developed by the motor at the maximum load, above friction, or 120 per cent. minus 35.4 per cent., or 84.6 per cent. of 2125 lb.; therefore, $T =$ 1796 lb., and WK^2 is, as before, 43,000; hence $\frac{T}{WK^2} = 0.0418$. S is the drop in the flywheel speed which actually occurred, or 17.01 per cent. of 286; therefore $S = 48.7$ r.p.m. t is the time between the peaks, or 30 seconds.

By using these values in Fig. 3 in the same manner as previously, it will be found that the curve $t = 30$ has not been extended far enough to cross the horizontal line at the intersection of $\frac{T}{WK^2} = 0.0418$ and $S = 48.7$. As these curves have been stopped at the value 99 per cent., it is evident that the motor would bring the speed to within less than 1 per cent. of the original value in the given time.

The Starting Conditions

To determine the starting conditions, Fig. 3 may be used much as before, but with different values of T, S and t. In this case it is required to determine the time which must elapse before the motor will bring the flywheel to speed. The value of T is the maximum torque of the motor less the friction torque. S is the full speed of the flywheel and t is to be determined. In induction motors having 15 to 20 per cent. slip, the starting torque will be practically equal to the maximum running or pull-out torque, which may be taken as 2½ or 2 times the full-load running torque. This value will vary according to the design of the motor, but the above are fair figures.

Hence, assuming that the starting torque will be 2½ times full-load torque, the value of T will be $2125 \times 2.5 =$ 5313, less friction torque of 650 lb., which is 4663.

Therefore,

$$\frac{T}{WK^2} = \frac{4663}{43{,}000} = 0.1095$$

$$S = 286.$$

From Fig. 3 it is found that the intersection of $\frac{T}{WK^2} = 0.1095$, and $S =$ 286 crosses the 99 per cent. line approximately on the curve $t = 40$. Hence the motor will be able to bring the flywheel within 1 per cent. of the full speed in 40 sec., and hence the time allowed, 60 sec., will be ample. This motor then will carry this load with but a momentary overload of 20 per cent., and will be able to bring the speed of the flywheel back to within a very small per cent. of its original speed, and the starting conditions are entirely satisfactory.

The Conditions Effected by a Different Motor

To show what effect a different motor would have, the same problem will be worked through on the assumption that a 125-hp. motor is to be used with the same full-load speed, 576 r.p.m., and a 20 per cent. drop in speed. The friction load represents 28.3 per cent. of the motor rating, and will produce a drop in speed of 5.66 per cent.

The motor speed at friction load is 679 r.p.m., and hence the full-load torque of the motor referred to the flywheel speed is

$$\frac{125 \times 5250 \times 679}{576 \times 286} = 2700 \text{ lb.}$$

If the motor carried the full load of 4300 lb., the speed drop would be

$$\frac{4300}{2700} \times 20 = 31.85 \text{ per cent.}$$

which is equal to 91.2 r.p.m. $= S$. From the curves, Fig. 3, the drop below initial speed in per cent. of S is found to be 48.5 per cent. Hence, the actual drop is 15.47 per cent., making the total drop in speed in the motor 21.13, or 105.7 per cent. load.

The accelerating and starting conditions do not need to be investigated, since this larger motor would be capable of bringing the flywheel up to speed in a shorter time even than the 100 hp. motor.

This motor is evidently amply large for this work, and hence the same-sized motor with a different percentage speed drop will be investigated, namely, a 125-hp. motor, with 15 per cent. speed drop. This motor would have a full-load speed of 612 r.p.m., and a drop, due to friction, of 4.25 per cent., or a friction speed of 689 r.p.m. Hence, the full-load torque of the motor at flywheel speed is

$$\frac{125 \times 5250 \times 689}{612 \times 286} = 2585 \text{ lb.}$$

If the motor carried the full load, the speed drop would be

$$\frac{4300}{2585} \times 15 = 24.95 \text{ per cent.}$$

or

$$S = 71.4 \text{ r.p.m.}$$

From the curve the drop in per cent. of $S = 57.5$, and hence the actual drop in the motor speed is 14.36 per cent. Added to this is the friction drop of 4.25 per cent., making a total of 18.61 per cent., which corresponds to a motor load of 124.1 per cent. This motor would accelerate the flywheel speed even more rapidly than the 125-hp. motor with a 20 per cent. speed drop, and hence is entirely satisfactory from this score.

Here, then, are two motors which are capable of carrying the load with approximately the same percentage overload, but with different speed drops. It is apparent then that the change from a 15 per cent. speed drop to a 20 per cent. speed drop made possible a reduction in the size of the motor, and hence gave a more nearly uniform load on the motor. The starting conditions must always be carefully investigated, since it is apparent that a smaller motor may be used by increasing the slip, which gives the motor less starting power, so that it may be found that either starting or accelerating is the limiting condition.

The Range and Limitations of the Curves

It is evident that curves can be used over a wide range of sizes of flywheels and of loads, greater than will be met with in ordinary practice, and will be found sufficiently accurate for any engineering calculations where it may be required to determine the exact performance of a flywheel and a motor working on a given load. It is to be borne in mind that Fig. 3 cannot be used to determine the action when the flywheel alone is used; that is, with the motor disconnected from the circuit, because the curves are based on the fact that the motor assists the flywheel which gives them a very different shape from that which they would have if the motor supplied no power and the flywheel alone carried the load.

It is also evident that the curves cannot be used for the determination of the regulation of a gas or steam engine as the curves are based on the action of the flywheel and the prime mover combined at all times; such conditions are not obtained during the cycle of a gas or steam engine.

In casting brass, always melt the coarsest material and that having the highest melting point first, and then add the more volatile or easily oxidized constituents.

"Katy" Line Shops at Parsons, Kansas

By F. A. Stanley

Some of the important things to be seen in a large railroad plant in Kansas, including many tools and devices pneumatically driven.

Portable boring and milling appliances; device for revolving engine driving wheels; traveling rig for drilling stay-bolt ends; air clamp for driller; and tools for blanking and punching sheet metal.

Machines used on spring work in the blacksmith shop.

The shops of the Missouri, Kansas & Texas Ry. at Parsons, Kansas, form one of the most interesting plants in the West. Special tools of various kinds are used extensively here in the overhauling of locomotives, and many home-made devices are to be seen in the different sections of the shops. The present article deals almost entirely with pneumatically-operated tools but some other classes of tools and operations will be illustrated in another article.

Portable Boring Bar and Port Miller

Figs. 1 and 2 illustrate two portable machines, one a boring rig for cylinders, the other a milling device for finishing the edges of steam ports.

The boring bar is mounted in bearings hung from brackets secured to the cylinder studs and the drive from the air-drill motor is transmitted through spur gears giving the desired speed reduction. The cutter head is fed along the bar by a screw with star feed.

The milling appliance, Fig. 2, consists of an air-driven spindle mounted in a head which is adapted to be fed along the crossrail by a hand-operated screw. The rail is attached to a substantial base plate which is secured by straps to the planed face at the top of the cylinder.

The spindle passes through a threaded quill which forms the means of adjustment vertically, and the head which receives the quill is carried by a cylindrical arm or shank which passes horizontally through the saddle, and which is provided with keyway and feather to prevent it from turning in the saddle. Suitable provision is made for adjusting the milling head forward to locate the cutter properly in the cored ports which require finishing along the edges. The cut taken is naturally not heavy and the feed screw is readily operated to pass the mill from end to end in the slot.

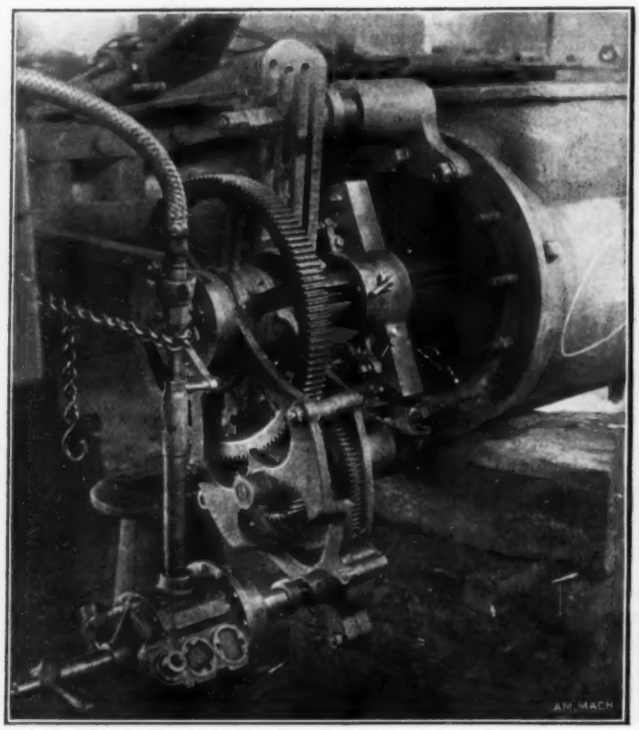


Fig. 1. Portable Boring Bar for Cylinders

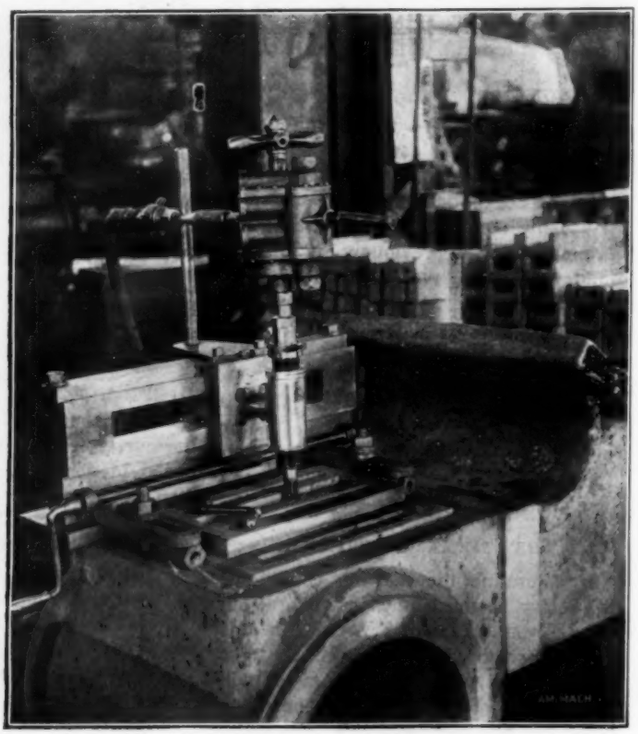


Fig. 2. Fixture for Milling Ports

Machine for Rotating Driving Wheels

The apparatus in Fig. 3 does away with the barring of drivers when adjusting eccentrics. The rig consists of two pairs of small rolls carried by blocks which are placed in contact with opposite sides of the drivers and then drawn together by through bolts to lift the pair of wheels from the track. One of the rolls is corrugated and is carried on the end of a wormwheel shaft which is driven by a worm connected to an air-drill spindle as clearly shown.

The corrugated roll thus serves as a medium for revolving the driving wheels, the three other rolls acting merely as supporting idlers. The wormwheel shaft has roller bearings at each end, made up of ⅜-in. rollers of soft steel, operating in a case-hardened bushing.

Pneumatic Clamps for Drillers

Fig. 4 shows a handy attachment applied to drillers of various sizes for holding the work without loss of time in fastening and releasing the piece.

The air cylinder under this drill table has a 6-in. bore and the stroke is 8-in. The piston rod extends up through the center of the table and is forked at its upper end to carry a long clamp bar which is pivoted at the center. The piston and clamp are lifted to release the work by a heavy spring between the underside of the piston and the bottom of the cylinder. The work is clamped by air pressure upon the upper side of the piston.

Oscillating Machine for Grinding-in Pipe

The appliance in Fig. 5 was constructed for grinding dry-pipes into flue

sheets. The rotary motion of the air-drill spindle is transmitted by an eccentric to a rocker arm which oscillates a horizontal shaft extending inward to the pipe and carrying three radially placed pointed jack screws which are set up tight inside the mouth of the pipe. The screw points engage the pipe hard enough to cause the latter to turn to and fro with the oscillations of the rock shaft and the pipe is thus ground in to a tight seat in the flue sheet.

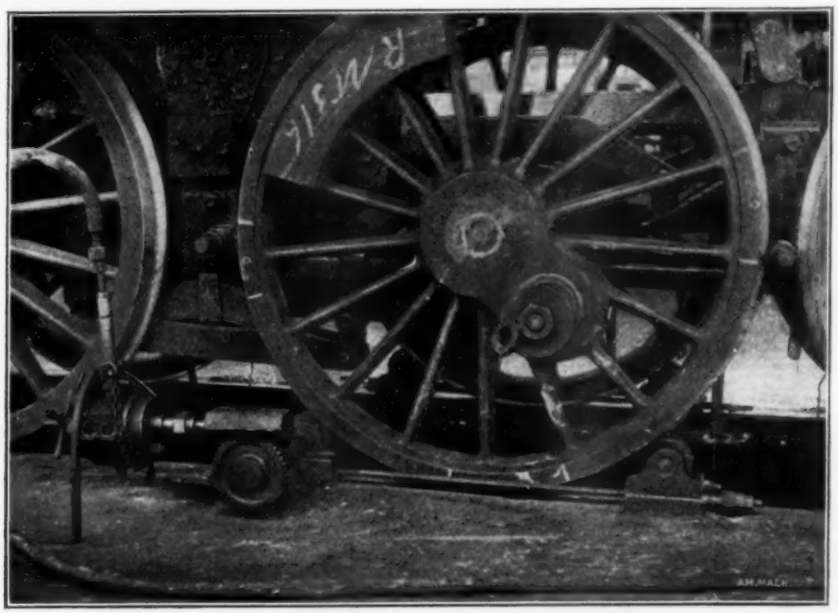


FIG. 3. MACHINE FOR ROTATING DRIVERS WHEN SETTING VALVES

A HANDY TRAVELING DRILL

The outfit in Fig. 6 forms a very convenient equipment for such work as the drilling of test holes in stay-bolts in boilers and for other operations where a lateral movement of the whole driller is desirable. The engraving represents the drill proper mounted in a metal frame which provides upper and lower tracks for it to travel on over a distance of eight or ten feet. The whole affair may be picked up by the crane and moved to any desired point in the shop.

The air drill is mounted at the end of a stiff shaft which is slid in its bearings by rack and pinion to feed the drill to the work and withdraw it for the next operation. The guide for this drill carrier is adjustably attached to a body which is mounted upon the threaded upright forming the driller column. Adjustment up and down the column is secured by a crank handle. The head is balanced by the counterweight shown.

The drill is adjustable in every direction and is readily clamped at the necessary angle for any hole to be drilled.

ATTACHMENT FOR PNEUMATIC CHISEL

The pneumatic chipping hammer in Fig. 7 is fitted up for cutting off stay-bolts in boiler work. As illustrated it is equipped with an attachment for holding a back jaw or anvil which is drawn up against the stay-bolt to be cut off with the chisel. In operation, the piece is cut nearly through with the chisel and then broken off with a blow of a hammer.

AIR HOSE TOOLS

The view in Fig. 8 shows a portion of the pneumatically operated equipment in the air-hose department. At the right-hand end of the bench there is a pair of cutting jaws for shearing the heads from rivets in the hose clamps. The hose is afterward split to release the coupling in the machine at the left end of the bench. Here the hose is placed in a V-block and the splitting chisel brought down to cut the end free from the connection.

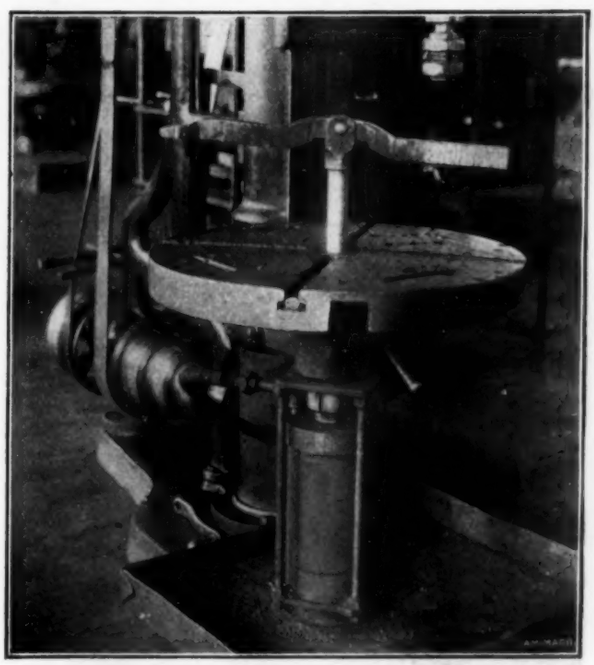


FIG. 4. PNEUMATIC CLAMP FOR DRILLER

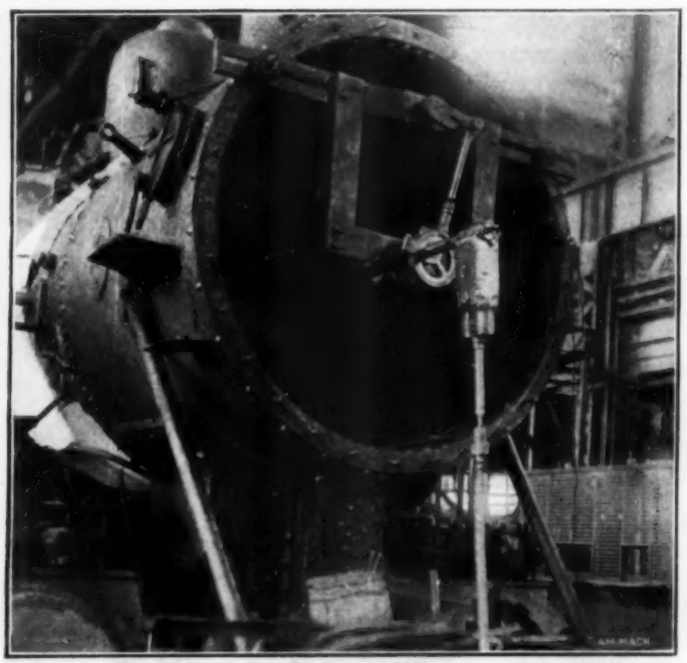


FIG. 5. RIG FOR GRINDING-IN DRY PIPES

The machine near the left end of the bench resembling a horizontal fan is a rotary internal wire brush into which the couplings as removed from the old hose are slipped for the removal of dirt and scale, this process fitting them for assembling in the new lengths of hose.

The apparatus at the center of the bench consists of a long vise in which the hose is gripped, and two air cylinders

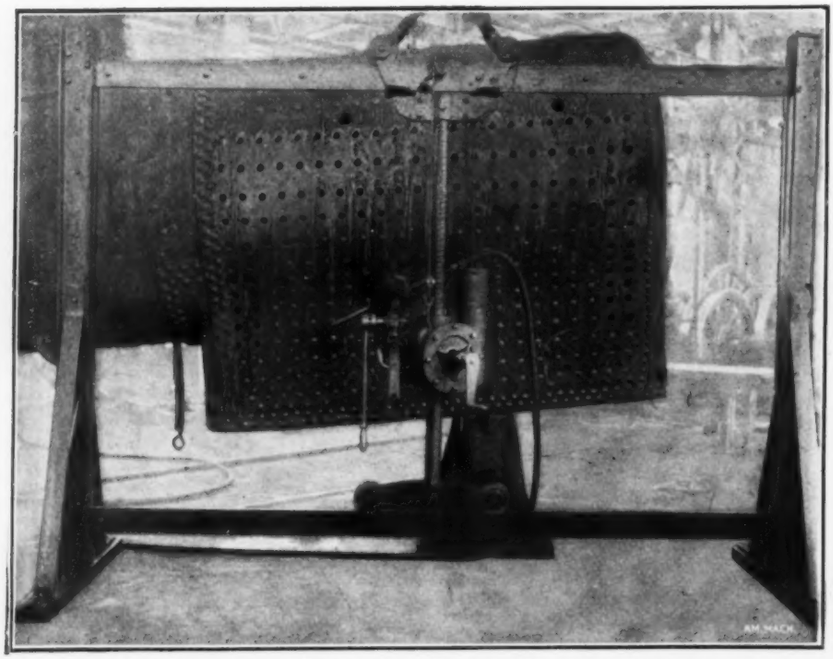


FIG. 6. PORTABLE DRILLER FOR PUTTING HOLES IN STAY-BOLTS

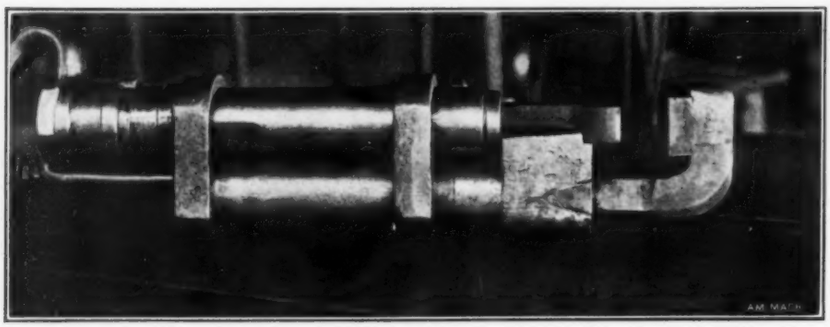


FIG. 7. SPECIAL CHISEL FOR CUTTING STAY-BOLTS

at the ends which supply pressure for forcing the connections into the two ends.

HANDLING SHEET METAL WORK

The two machines in Figs. 9 and 10 are pneumatic punch presses for sheet-metal

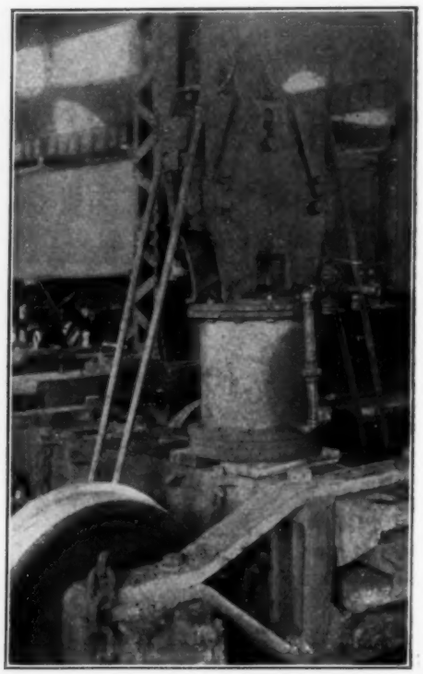


FIG. 13. RIG FOR PULLING DOWN TRUCK SPRINGS

operations. The one in Fig. 9 carries sixteen $\frac{3}{16}$-in. punches for piercing as many holes at each stroke in locomotive jackets of russia iron. The other

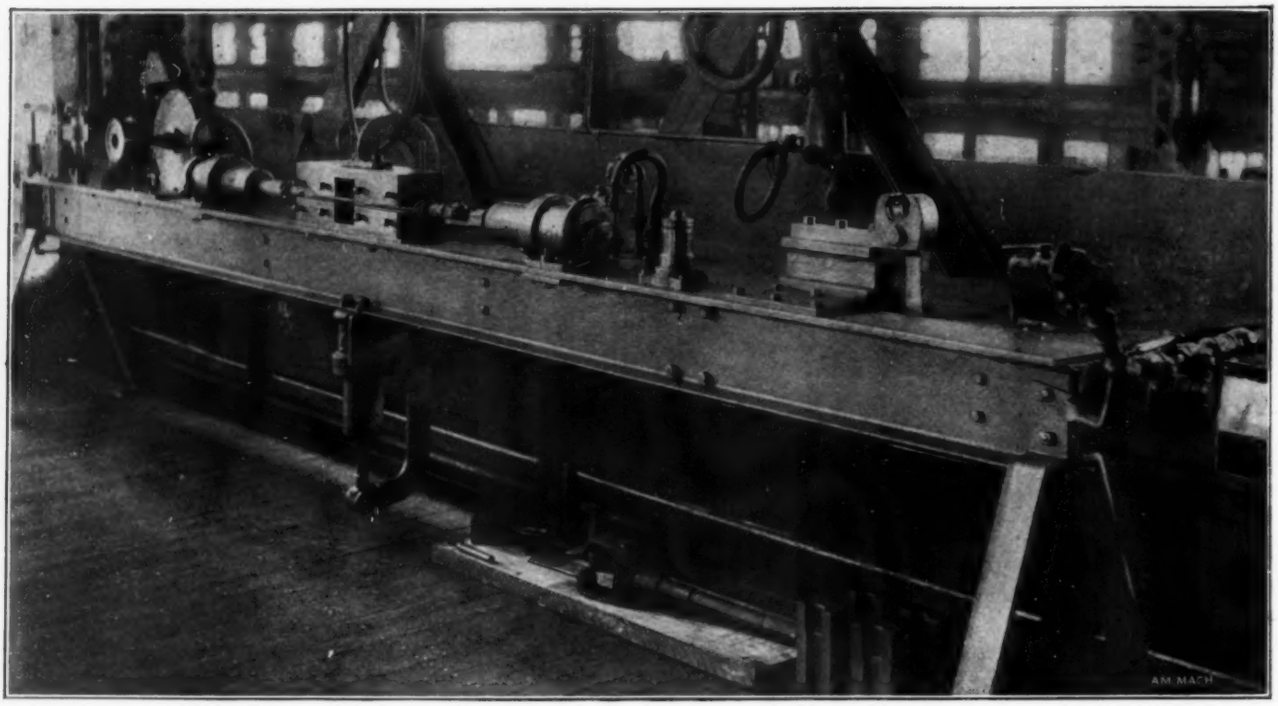


FIG. 8. A PORTION OF THE PNEUMATICALLY OPERATED EQUIPMENT

press pierces and blanks out a body for a tin torch.

In both cases the rams with the punches are operated by a pair of rocker arms connected by toggles with the air piston. It will be seen that the effect of this arrangement is to produce a complete down stroke and return stroke of the punch by a single stroke of the piston in either direction. That is, as the piston descends the punch is forced through the work and then withdrawn. When the piston lifts, the punch is again moved through its down and up strokes.

The range of movement is, of course, quite limited, but it is sufficient for the special work for which the apparatus was constructed. These air-operated presses are placed along the gallery structure where they occupy very little space that could otherwise be utilized by machinery, and they are found highly satisfactory for the classes of work for which they were built.

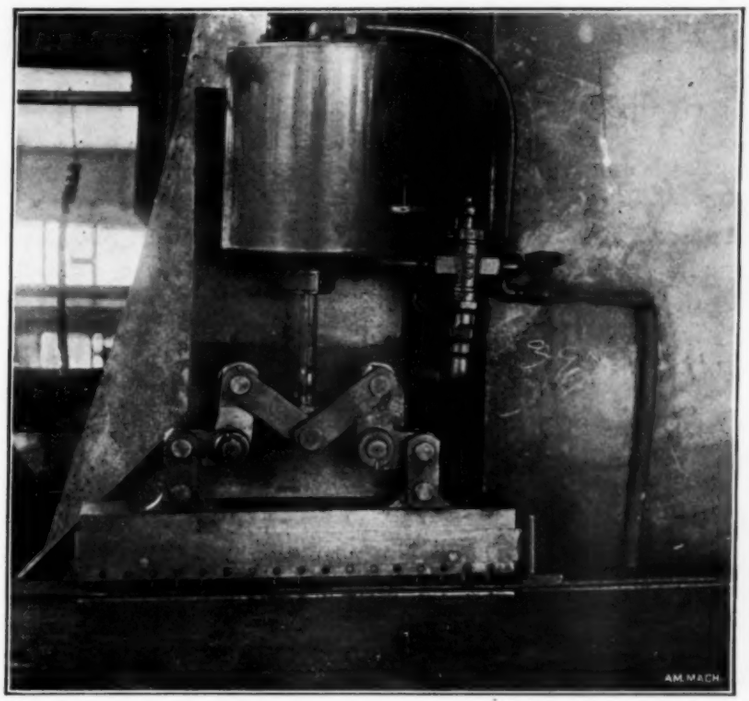


FIG. 9. PNEUMATICALLY OPERATED PRESS TOOLS FOR SHEET-METAL WORK

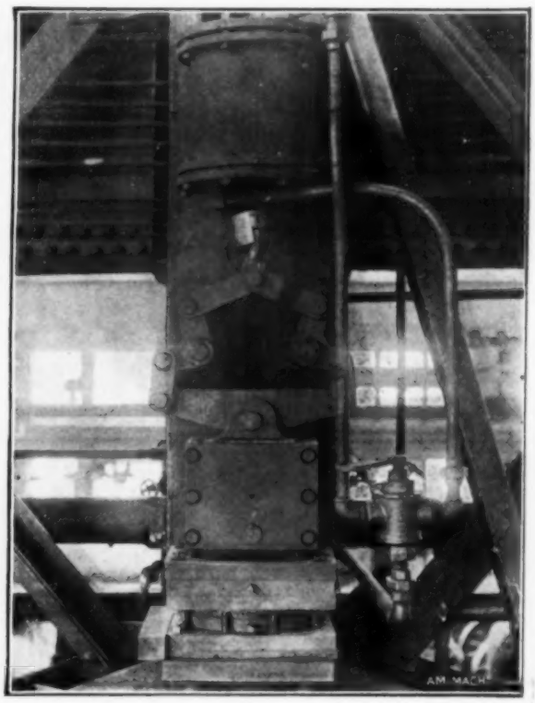


FIG. 10

FIG. 11. MACHINE FOR FORCING BANDS ONTO SPRINGS

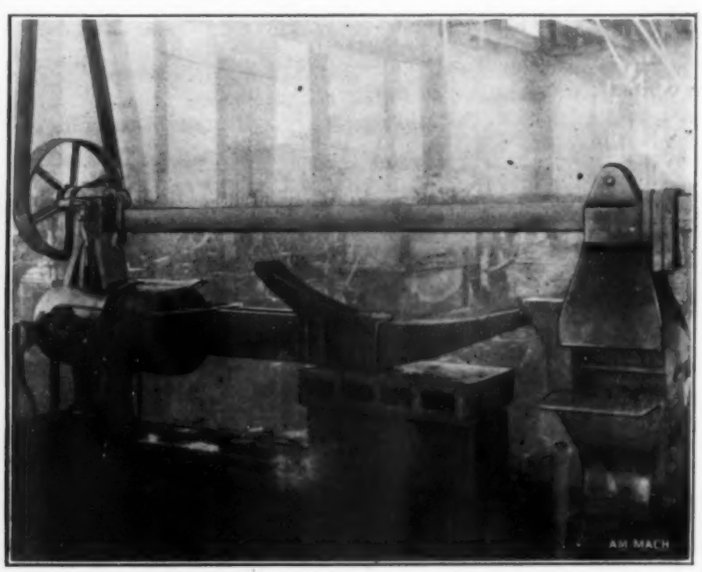


FIG. 12. HYDRAULIC MACHINE FOR REMOVING BANDS FROM SPRINGS

OPERATIONS ON SPRINGS

Figs. 11 and 12 are two machines for banding springs and for removing the bands from old springs. One of these springs is shown in Fig. 12, the machine in this view being a form of hydraulic press.

The band to be removed from an old spring is heated and then the spring is placed in the press, Fig. 12 with one end resting against the adjustable abutment and the other end between the jaws extending from the ram. The ends of these jaws project far enough to pass along the sides of the spring and act against the hot band, which is thus pressed off without difficulty and without injuring the band itself.

In putting bands onto springs in the pneumatic machine, Fig. 11, the built-up set of leaves is gripped in the vise by the action of one of the pistons, then the hot band which has been slipped freely over the bent members of the spring, is

worked down and fitted tight to the spring by the kneading pressure applied from the top by the long lever and from the sides by the horizontal pistons. The flat dies or shoes thus forced against the hot band work it down evenly and smoothly to the body of the spring.

The various air cylinders and the controlling apparatus are shown clearly in the engraving.

A portable appliance is illustrated in Fig. 13 for pulling down tank-truck springs to enable the through bolts to be put into place. The cylinder is placed upon the truck and the yokes connected under the truck are slipped over the ends of the lifting bar at the top of the rig. The motion of the piston is transmitted by toggle joints to the lifting bar and the side yokes, and the truck springs are thus closed sufficiently to allow the bolts to be inserted.

Grinding Circular Saw Teeth

By C. W. Reynolds

Nearly all machine shops have woodworking departments using circular saws and the ordinary method of sharpening, I believe, is with a file, which, owing to the uneven hardness of the saw, proves very expensive as to time, and very unsatisfactory in results. The teeth that are hard are filed very little, and that only on extreme points, while the soft teeth are filed on face, top and point, and after one or two filings the teeth are of all shapes and sizes, the saw is out of true and balance and the result is a very hard, poor and slow cutting saw.

With the arrangement shown in Fig. 1 used on a Cincinnati universal grinder, saws from four feet down to five or six inches in diameter can be easily, quickly and accurately ground not only on the top but the entire tooth, and it is surprising how much better and faster the saws cut.

On some of the saws that we ground after we made this fixture, the distance from the face of one tooth to that of another, varied from ¾ to ⅛ inch, and in these cases we took a thin emery wheel and cut off the extra stock on the faces, broke the pieces off, put on a No. 12 wheel, 10 inches in diameter and ½ inch thick and proceeded to grind.

We made our ratchet or indexing disk, about two-thirds as large as the saw, with, of course, the same number of teeth.

After the machine is set up and started, it works automatically, as the forward movement of the table causes the ratchet and pawl to engage, imparting a rotary motion to the saw, which causes the wheel to grind the back of tooth from the point to the root, then as the table reverses the side of the wheel grinds the face.

Of course, the grinding cannot be completed in one revolution, but at each complete revolution more feed is applied and the machine will do the rest and will require but very little attention.

Fig. 2 shows the fixture in detail. *A* is the base bolted to the grinder table which holds the saw and indexing disk, *B* and *C*. A fiber friction washer is placed at *D* to prevent the saw turning while the face of the tooth is ground as the table moves back. *E* is a bracket to which is bolted the support *F*, used to steady the saw close to the tooth being ground.

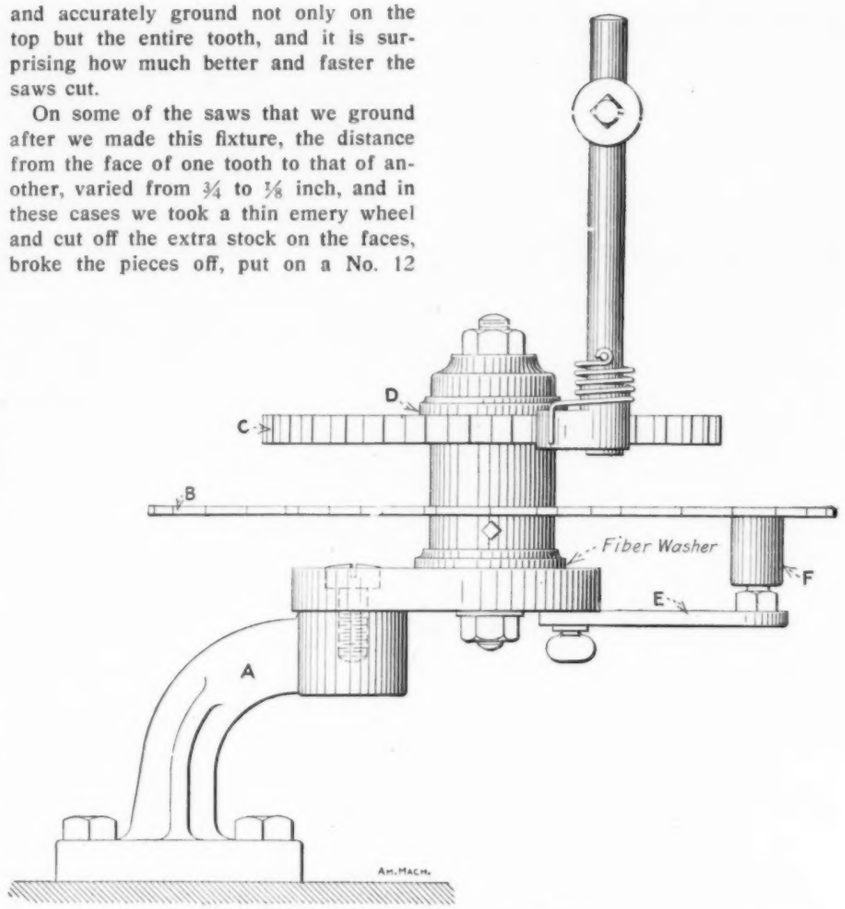


Fig. 2. Details of Grinding Fixture

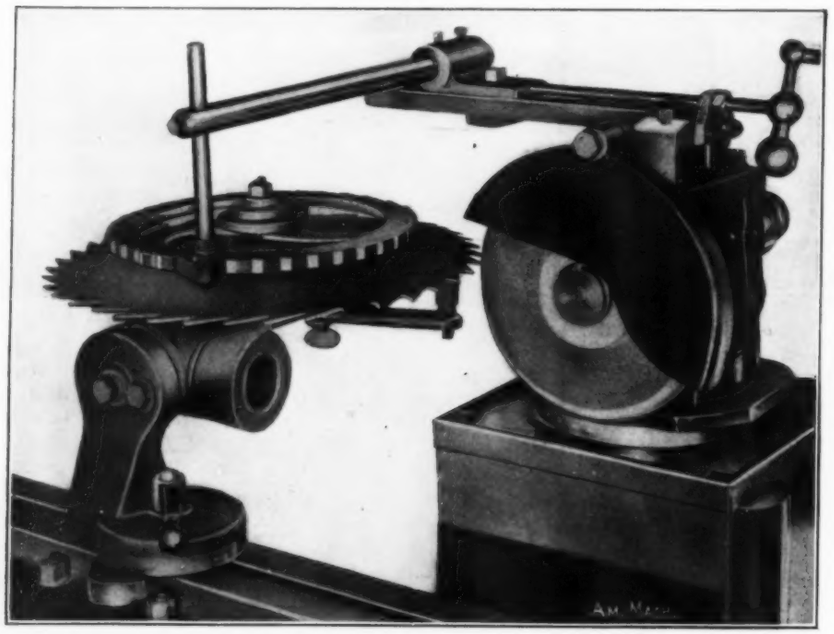


Fig. 1. Circular Saw Tooth Grinding Fixture

The principal air-compressor plants on the Panama Canal are at Los Cascadas, Empire, Rio Grande and Balboa. These frunish air to the Central and Pacific divisions, and along the high line around Gold Hill on the relocation of the Panama R.R. For the year ended June 30, 1911, the total output of these plants aggregated 8,261,199,541 cu.ft. of free air, at a cost of 0.0324c. per 1000 cubic feet.

Magazine Work on Screw Machine

By S. Nevin Bacon

Unusual methods of performing second operations on pieces by means of special magazines and the necessary cutting tools on automatic screw machines.

Some peculiar work requiring assembling of two or more pieces, accomplished readily with the aid of magazine attachments.

The economy of magazine work on the automatic screw machine seems to be little realized by many manufacturers today, possibly because their time is taken up with other labor- and money-saving devices. During a recent trip through several of the large Eastern factories, only one firm in six was discovered using magazine attachments on its screw machines. When it was suggested to one superintendent that the work he was doing on six hand machines could be done on six automatics, he exclaimed:

I never use magazine attachments because the work has to be rehandled to place it in the magazine and it could just as easily be placed in the hand screw-machine chuck.

He never stopped to consider that only one operator instead of six would be needed.

A larger and more progressive factory in the same town was manufacturing in large quantities the piece shown in Fig. 1. This piece was made on a No. 00 Brown & Sharpe automatic screw machine. In the first operation the piece was finished on the end *A* from the bar stock, the second operation (which consisted in grooving and drilling the other end) being performed on another machine, using the magazine attachment shown at Figs. 2 and 3.

One Type of Magazine

This attachment can be made cheaply in any shop, the one shown being made of sheet steel. In Fig. 2 is shown the method of clamping to the back cross-slide, and this is also seen at *A*, in Fig. 3. It would not be practical to load the magazine box *B*, Fig. 2, by dropping the pins in one by one, so for this reason an inner box is constructed of lighter material. This box can be withdrawn, as it works like a vertical drawer. Two of the inner boxes are used, one being reloaded while the other is in use. With this arrangement it is practicable for one operator to handle as many magazine machines as on regular work, say from four to six.

In operation the magazine comes forward, as in Fig. 3, until the center of the work lines up with the center of the chuck, which opens to receive it, when it is pushed forward by the special stop *B* held in the turret. After the piece is in and the chuck closed, the manner of operating is the same as on bar stock, except that it need not be cut off. Instead of this the piece is ejected by the spring plunger, the spring being compressed when the piece is pushed into the chuck.

To make it a little clearer, *D*, Fig. 3, is the collet or chuck shown in section in the end of the spindle. The hole is smaller than the work, to keep the lower piece from falling out of the magazine and the springs *F* answer the same purpose on the opposite side. The magazine boxes are cheap, and one is made for each job, unless there are several parts of nearly the same size and shape.

Order of Operations

The order of operations for this piece is given as follows:

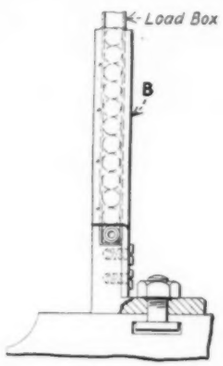


Fig. 2

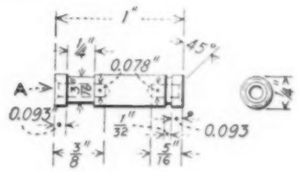


Fig. 1

Fig. 5

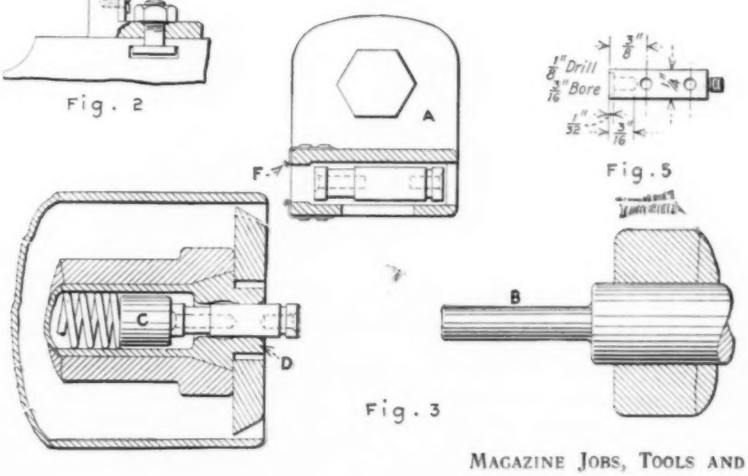


Fig. 3

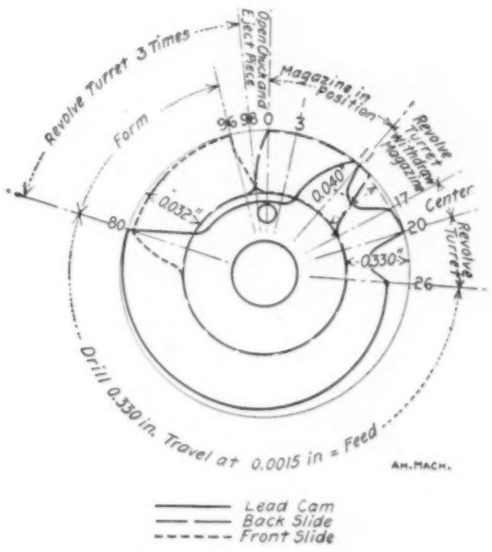


Fig. 4

Magazine Jobs, Tools and Cams

ORDER OF OPERATIONS FOR PIECE SHOWN IN FIG. 1

	Spindle speeds, 1200 r.p.m.	2400 r.p.m.	Hundredths of cam
Bring forward magazine (back slide)...		44	11
Push piece into chuck with stop held in turret and close chuck		32	0
Revolve turret and withdraw magazine		24	6
Center 0.040-in. travel at 0.0033-in. feed...		12	3
Revolve turret.....		24	6
Drill 0.330-in. travel at 0.0015-in. feed..		216	54
Revolve turret three times	(36)	72	18
(Form 0.032-in. travel at 0.001-in. feed)..	(32)	(64)	(16)
Open chuck and eject piece		8	2
Total number of revolutions for one piece.....		400	100

The time required for one piece is ten seconds, net product, 3200; gears, 40-40. The maximum surface speed of stock for forming is 78.6 ft. per min., and the maximum surface speed for the drill 49 ft. per minute.

One thing noticeable about the order of operations is that the turret must be revolved three times (using special time) to bring the stop to place after drilling, for this reason the job is always run on an old machine having five holes in the turret, thus saving revolving the turret once.

The Cams Required

A very interesting set of cams for this piece is shown in Fig. 4. The magazine is brought forward and held in position by the cam lobe 0 to 11, while the lobe on the turret, or lead cam, at 11 pushes the piece into the chuck. The dog for operating the withdrawal of the turret should be set to work when the cam roll is on 11, as the stop must be withdrawn from the magazine before it can drop back.

The clearance from 96 to 98 insures the form tool being out of the way before the piece is ejected from the chuck, which occurs from 98 to 0. The forming could be performed in much less time, but the space 80 to 96 is required to revolve the turret. A very important thing in laying out cams is usually overlooked by those engaged in this work. In looking over this set of cams, it will be noticed that six hundredths have been allowed to revolve the turret. Referring to the table for the No. 00 machine, we find that for a ten-second job five hundredths of cam surface is given to revolve the turret. The cam designer should always give an extra hundredth, as was done in this case; this allows the machine to be geared up on occasion to nine seconds.

Similar Piece with Different Operations

Another No. 00 job, with entirely different operations, is shown in Fig. 5. This piece is formed, threaded and one hole drilled on the first operation. The second operation, using the magazine on the automatic screw machine, consists in drilling and counterboring the end hole and cross-drilling the larger hole through the side. This hole has no relation to the other side hole, except as regards the distance apart, which is ½ in. The magazine is similar to the one just described.

The gross production in 10 hours is 2770 pieces, the net production 2400. The gears are, 40 driver and 52 driven. The speed of the cross-drill is the same as that of the spindle. The maximum surface speed for the drill is 51 ft. per min. The maximum surface speed for the counterbore, 76 feet per minute.

A Two-piece Job

Work, like that illustrated in Fig. 6, shows up the magazine attachment at its best. The section at *A* shows how the piece was originally milled from a solid piece. This method of operation being too expensive, the piece was later made in two parts, as shown, and the ¼-in. diameter pin was driven in so that its ends projected on either side. When magazine methods came into use, this piece was completed on the automatic screw machine and the pin was pressed in automatically instead of being driven in by hand on the bench.

Here it is necessary to use a special magazine, and attention is called to the fact that both cross-slides are in use and also the magazine, which is shown by the section *A*, Fig. 7. A better idea of the manner in which the magazine was mounted on the machine is given by Fig. 8. To understand this view thoroughly, we must notice the dotted line which represents the end of the spindle, and shows at once that the view is from the front of the machine.

The magazine box is seen at *A* loaded with pins, which are indicated by the circles one on top of another. The bolts shown are to fasten the arm (which supports the magazine box) to the bed of the machine. These bolts go into the holes

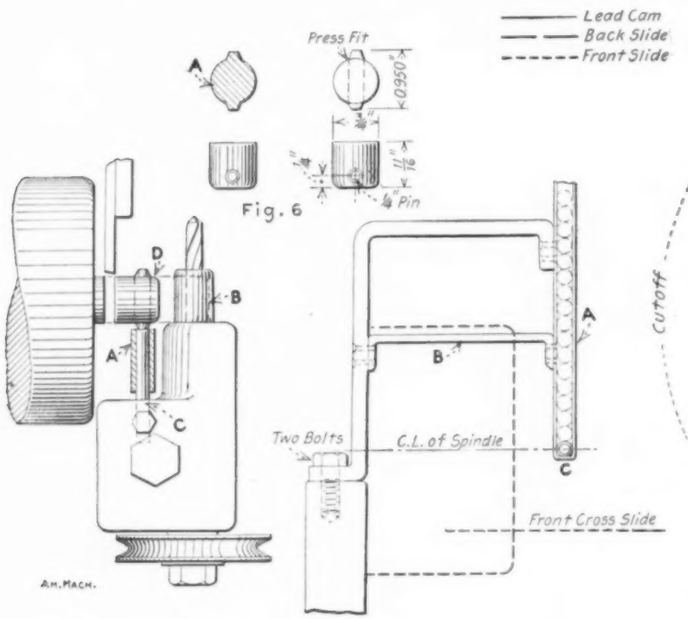


Fig. 7. Plan

Fig. 8. Front Elevation

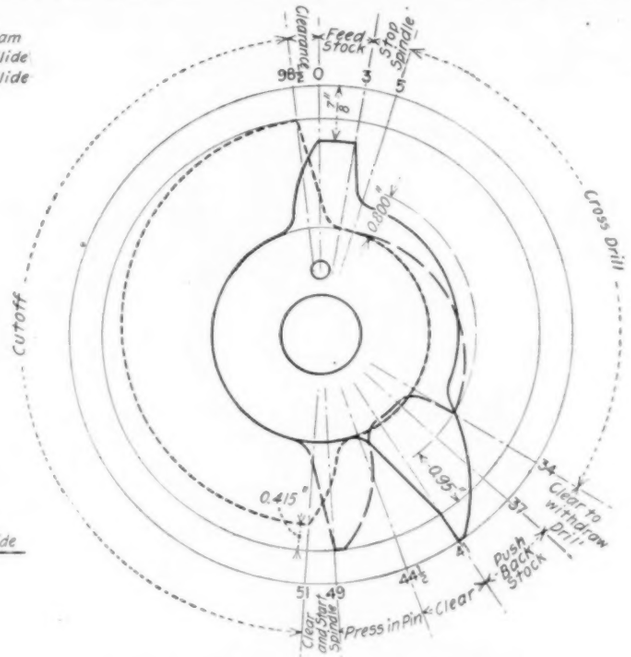


Fig. 9. Cams for Work Shown in Fig. 6

Assembling Operation on the Automatic Screw Machine

The cams are not shown as they are not unusual, the following order of operations being sufficient to show how the piece was handled and cross-drilled.

ORDER OF OPERATIONS FOR THE PIECE IN FIG. 5

	Spindle speed, 1560 r.p.m	Hundreths of cam
Bring forward magazine and open chuck	37	11
Push piece into chuck and close chuck	(27)	(8)
Revolve turret and withdraw magazine	16	5
Center 0.056-in. travel at 0.004-in. feed	14	4
Revolve turret	14	4
Drill 0.197-in. travel at 0.0025-in. feed	81	24
Revolve turret	14	4
Counterbore 0.042-in. travel at 0.004-in. feed	10	3
Stop spindle	3	1
Cross drill 0.270-in. travel at 0.002-in. feed	135	40
Clearance	7	2
Revolve turret three times	(42)	(12)
Open chuck and eject piece	7	2
Total number of revotions for one piece	338	100

provided for the slotting attachment, the attachment being hung in this manner for the drilling attachment on the front slide to pass under the supporting arm *B*. The difference in this magazine attachment, as compared with ost others, is that it is not mounted on either cross-slide, but is fastened to the machine bed.

A Curious Problem

In making the piece the stock is fed to the length shown by the dotted lines *B*, Fig. 7, and while in this position the spindle is stopped and the hole cross drilled. Right at this point a difficult problem arises: We must use the front slide to push the pin in but as the drill, of course, is in line with the hole just made it would seem that the only means would be to push in the pin with the point of the drill. Or if the pin is pushed in with the back slide on which is mounted the cutoff tool, then the pusher must interfere with the stock when the slide advances further forward to cutoff.

The solution of this problem is to mount the pusher as shown at *C*, and after the hole is cross-drilled come forward with the turret and push the stock back into the chuck as shown by the end of the piece *D*. Now when the front slide moves forward to push the pin out of the magazine the drill will clear the end of the stock.

Now that the pin is pressed into the hole, the front slide drops back and the pusher *C* withdraws from the magazine, which allows another pin to drop down into place as at *C*, Fig. 8.

An Important Point

After the hole is cross drilled and the chuck is opened to push the stock back there is danger of the bar turning slightly around in the open chuck. This means that the pin would not line up with or enter the hole just drilled. For this reason the operator must be sure to use the key which connects the feed tube to the spindle, as the feed finger gripping the stock will prevent it from turning, since this feed finger is fastened to the end of the feed tube which is keyed to the spindle, which is, of course, clamped dead for cross drilling. This is mentioned because the key in the feed tube is invariably removed or ground off the feed tube for convenience in inserting the tube into the spindle.

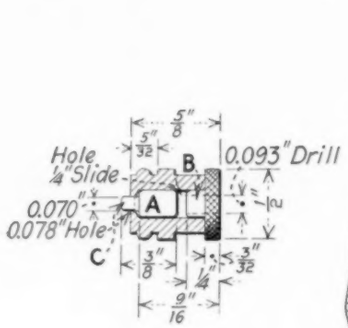


Fig. 10

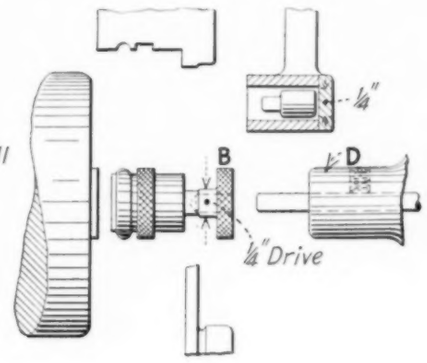


Fig. 11

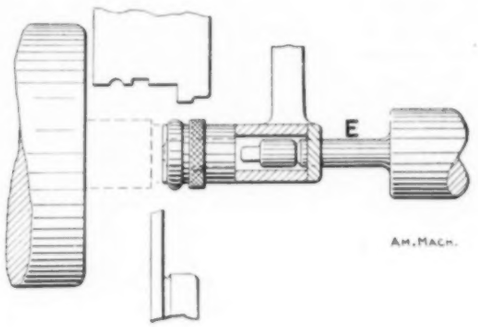


Fig. 12

Another Assembling Operation

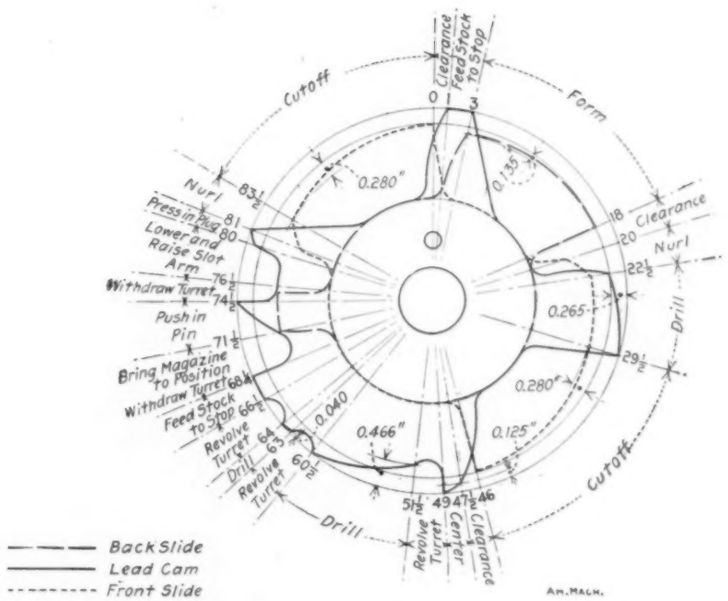


Fig. 13. Cams for Work Shown in Figs. 10, 11 and 12.

The order of operations is given below:

ORDER OF OPERATIONS FOR PIECE SHOWN IN FIG. 6

	Spindle speed, 480 r.p.m.	Hundreths of cam
Feed stock to stop	17	3
Shift to dead pulley to stop spindle	17	2
Cross drill from front slide 0.800-in. travel at 0.0048-in. feed	163	29
Clearance to withdraw drill	17	3
Bring stop forward, open chuck and push stock ½ in. into spindle	22	4
Return stop for clearance	14	3½
Push in pin with front cross-slide	25	4½
Clear and start spindle	11	2
Cut off 0.415-in. travel at 0.0015-in. feed	266	47½
Clearance	8	1½
Total number of revolutions for one piece	560	100

The net production for ten hours is 450 pieces. Time to make one piece complete, 70 seconds. The gears are 40-80, 60-70. The maximum surface speed of stock is 94½ ft. per minute. The speed of the cross drill is the same at the machine spindle speed, 480 revolutions per minute.

The set of cams is shown by Fig. 9, on the cam circle from 5 to 34 is shown the cam for cross drilling. The clearance from 34 to 37 is very important, as the drill must be entirely out of the spindle before the work is pushed back, and again clearance is shown from 41

to 44½ which insures the stop being back out of the way to clear the drill and holder on the front-slide. The pin is pressed into the hole from 44½ to 49 and the clearance from 49 to 51 is necessary to drop the front slide back so that the pin in revolving does not strike.

Another Assembling Operation

Another good example of assembling work on screw machines with the use of the magazine attachment is shown in Fig. 10. This piece is manufactured on a No. 0 Brown & Sharpe machine by an electric-clock concern in the South. The little plunger at *A* is made a close sliding fit and the plug *B* is pressed into the same hole.

The method of setting up the job is shown in Fig. 11. This time the magazine is mounted on the back slide with the form tool, and is clamped with the same bolt. The magazine stands away from the form tool far enough to clear the end of the bar when the form tool comes forward to the cut.

An unusual feature of this layout is that the front slide comes forward to knurl and cut off twice for every completed piece. In operation the stock is fed to the stop and the piece is formed with the form tool on the back slide. The piece *B*, Fig. 11, is now knurled with a cross-slide knurl clamped to the cutoff tool as usual. An interesting feature is that at this point the front slide dwells to allow the piece to be centered and drilled before it is cut off. This is done in order to knurl the work before it is weakened by the hole. Just before the piece is cut off it is grasped by the carrier *D* which is held in the slotting arm the same as a slotting bushing.

Inserting the Plugs

The piece *D*, Fig. 11, is now drilled through and fed out to the length shown in Fig. 12 and when it is in this position the magazine comes forward and the special stop *E* pushes the plunger into the work, only as far as the end of the piece, however, because this stop, it should be remembered, was just used to feed the work against. As soon as this stop and the magazine have dropped back to clear, the slotting arm lowers and inserts the plug (which is tapered on the end) partly into the hole. The stop again comes forward and presses the plug into the hole, the piece is now complete and is cut off.

The cutoff tool does not interfere with the end of the plunger at *C*, Fig. 10, because the piece drops before the cutter reaches this point. This leaves a small burr which is removed afterward. Also, when cutting off this end does not protrude because the plunger has not been pushed out that far. The order of operations is as follows:

ORDER OF OPERATIONS FOR WORK SHOWN IN FIGS. 10, 11 AND 12

	Spindle speeds, 810 r.p.m.	1800 r.p.m.	Hundreths of cam
Clearance		18	1
Feed stock to stop		36	2
Form 0.135-in. travel at 0.00107-in. feed	126	270	15
Clearance		36	2
(Revolve turret)		(54)	(3)
Knurl	25	45	2½
Drill 0.265-in. travel at 0.0021-in. feed		126	7
Cutoff 0.280-in. travel at 0.0021-in. feed	135	297	16½
(Revolve turret)		(54)	(3)
Descend slot arm, raise piece clear		27	1½
Clearance		27	1½
Center 0.125-in. travel at 0.0046-in. feed		27	1½
Revolve turret		45	2½
Drill 0.466-in. travel at 0.0063-in. feed	74	162	9
Revolve turret		45	2½
Drill 0.040-in. travel at 0.0022-in. feed		18	1
Revolve turret		45	2½
Feed stock to stop		31½	1¾
Withdraw turret, bring forward magazine		58½	3¼
Push in pin		54	3
Withdraw turret		36	2
Lower and raise slot arm		63	3½
Press in plug		78	1
Knurl	25	45	2½
Cutoff 0.280-in. travel at 0.0021-in. feed	135	297	16½
(Revolve turret)		(54)	(3)
Total number of revolutions for piece		1800	100

The time to complete one piece is only 60 seconds which gives a gross product of 600 pieces in ten hours or 525 net. The gears used are 30 driver and 60 driven. A special double cam is used with the slotting arm to lower and raise it twice as the usual cam actuates the arm only once for a piece.

Cam Features

The cams are shown in Fig. 13. Very little description is necessary. The part from 68¼ to 71½ is to allow the stop to be withdrawn so the magazine does not strike when it comes forward; it is also necessary to clear the slotting arm at 74½ to 76½. The cam-lobe for operating the magazine is shown in dash lines from 71½ to, and a little over, 74½. It is lapped over in order to make sure it does not withdraw until the stop is out. It is necessary to revolve the turret as late as possible after the finished piece drops, otherwise the long stop would strike the work.

Operations such as have just been described are common enough with special machinery but especially interesting in view of the fact that the work is done on a standard make of machine. The magazine attachment if given a fair trial is sure to prove simple, practical, and, most important of all, economical.

Embossing Ratchet Teeth in a Punch Press

By Aron Lawrence

A small steel ratchet is shown in Fig. 1. This for a long time had been made by blanking out the part in a screw machine, and then cutting the teeth in an indexing milling fixture. As there are some forty teeth in the ratchet, this meant about twenty indexings, and obviously was a slow method of production. It was finally decided to try stamping the teeth in a blank in a punch press, and a die similar

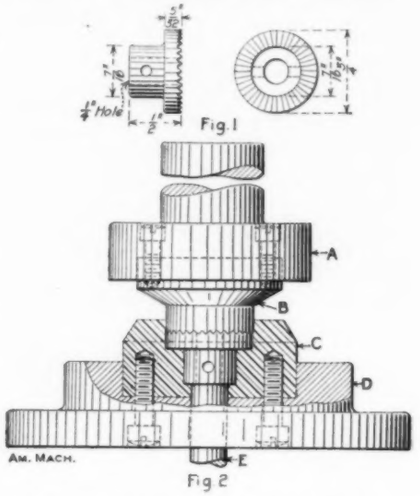


Fig. 2

Die for Embossing Ratchet Teeth in a Punch Press

to that shown in Fig. 2 was used for the purpose.

Referring to the illustration, *D* is a cast-iron die shoe bored out for the reception of the hardened tool-steel die *C*, which is secured thereto by heavy machine screws. The die is recessed, as shown in the illustration to receive the work, and a steel knockout rod *E* is provided for the ejectment of the embossed piece.

The punch holder *A* is of cast iron, and carries the embossing punch B of hardened tempered tool steel. The punch is serrated on its lower surface to form the teeth on the work, and is attached to its holder by heavy machine screws.

In experimenting with this tool, it was found impractical to press the teeth into cold blanks, as the metal would not rise between the punch teeth enough to form a sharp tooth profile. However, by heating the blanks, very fine results were obtainable and without much strain on the press and die.

Of course, to handle this kind of work properly a regular coining press should be used, as the frame of such a press is designed to effectually withstand the stresses, but in this instance an ordinary press was used, as a coining press was not available. The teeth produced by this method are perfectly satisfactory and are undoubtedly stronger than the milled teeth, due to the increased density of the metal after embossing.

Only from 20 to 35 per cent. of the fund expended in the United States for liabilities insurance is paid to the injured workers. In Germany 77¼ per cent. is so used.

The Designing of Machine Vise Jaws

By Lucian L. Haas

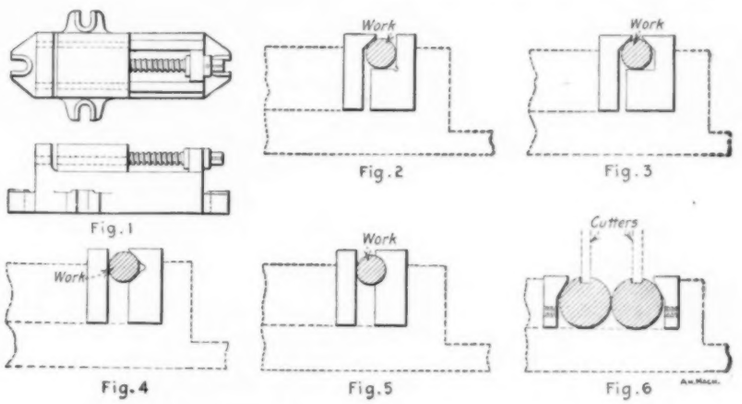
The necessity of rigid construction universally recognized by designers. Old designs perpetuated because of the economic interchangeability of parts. An assortment of vise jaws, their construction, use and operation.

The many different styles of vises call for a great deal of ingenuity on the part of the designer, and they all, without exception, show that they have been handled by experienced men who realized the necessity of rigid construction, as well as compact and neat design.

A great deal of time has also been spent on the important point of quick-acting vises, although this feature has not been improved upon to any great extent, except by the recent designers.

Many vise manufacturers who still stick to their original design, do so probably, because of the interchangeability of parts, rather than for any other reason. This means a great deal when it comes to manufacturing and replacing broken parts.

Work held in the vise is the source of much comment between the tool designer and his superior, and frequently the designer is forced to design expensive milling fixtures which, in many cases, are nothing more than a huge vise. The fact that manufacturers supply the vise as part of the equipment of their milling machines demonstrates the general usefulness of the vise. Yearly large sums of money are spent in their vise departments perfecting design and workmanship.



THE DESIGNING OF MACHINE VISE JAWS

AN ASSORTMENT OF VISES

For general manufacturing purposes the vise illustrated in Fig. 1 is a fairly representative type, and it can be clamped rigidly in almost any position on the miller table. It is this type of vise which the tool designer comes in contact with most when designing jaws for special purposes. Swivel bases, with graduated scales for setting the vise at given angles, are a distinct necessity for toolroom work; but for manufacturing it is best to dispense with an extra movable surface coming between the cutter and the work.

In Figs. 2, 3, 4 and 5 are shown designs of vise jaws suitable for holding small, round stock while milling keyways or similar operations. Two larger shafts may be milled at the same time by providing jaws as illustrated in Fig. 6, when the limits of accuracy are sufficiently wide to allow for slight variation in the size of the bars. Fig. 7 is a good method of holding stock of even size for gang-milling a bar to a number of short lengths.

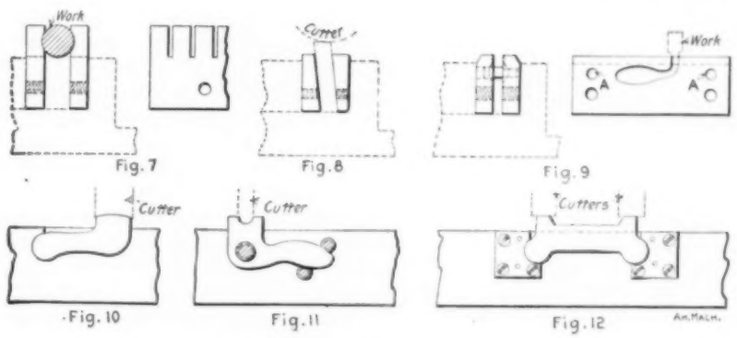
An almost standard type of jaw is seen in Fig. 8. This kind is used largely in the toolroom for milling the clearance on form cutters, but it demonstrates a method applicable to other work for throwing the job over at an angle. Fig. 9 shows a jaw in which the metal is cut away, as in a die, to hold a forging or casting of irregular shape. The dowel pins *A A* are for lining up and resisting the tendency of the jaws to move sideways, caused by gripping on an irregular form. Without these pins the work of resisting this lateral motion would come entirely on the threaded part of the screws holding the jaw in position. Also by changing the jaws from one vise to another correct alignment is immediately secured.

A similar die-form jaw is shown in Fig. 10. An idea is conveyed of how rigidly a piece may be held by this method for taking a broad heavy cut across a piece of somewhat delicate form. In Fig. 11 the piece is seen located by means of pins. These pins should be made as short as is consistent with proper locating in order to save time in taking out one piece and putting in another.

Another phase of the die-type jaw is shown in Fig. 12. In this case pieces are added, by means of which the location is secured; this is probably a cheaper method in many cases, and also lends itself to easy alteration in the event of slight change in the size or shape of the part being machined. This will appeal to those having had experience on batches of the same casting coming from different foundries.

A very neat method of holding small turned pieces of uniform size, such as screws, pins, etc., is seen in Fig. 13. The number of pieces that a clever operator can mill in a short time by this method is surprising.

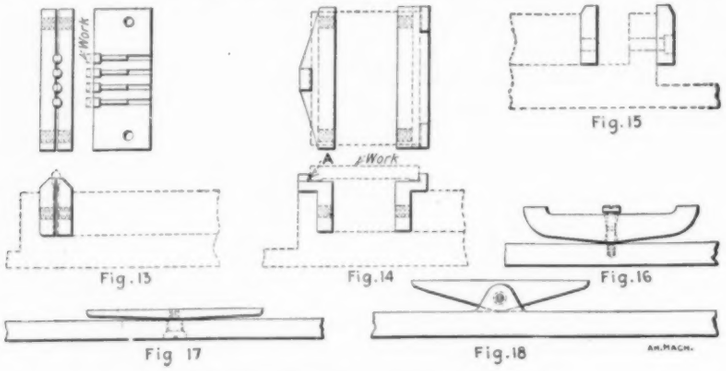
The extended jaw, shown in Fig. 14, is a type of very wide application and specially adapted to holding thin flat pieces beyond the capacity of the ordinary range of the vise. The part of the jaw *A* in contact with the side of the piece is cut away to form a gripping edge; this is a very effective method of resisting any lifting tendency. Fig. 15 is also another application of the case when the work is too long to go between the standard jaws of the vise, but is hardly adapted for heavy work.



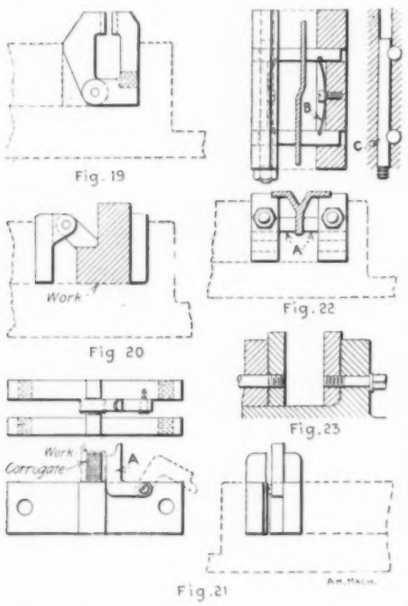
THE DESIGNING OF MACHINE VISE JAWS

VISES WITH COMPENSATORS

Three methods of the application of compensating, by which two pieces of unequal size may be held rigidly at one time, or a rough casting gripped on two points, are illustrated in Figs. 16, 17 and 18. In Fig. 16 the compensator is free to move about the retaintng screw, while in Fig. 17 the retaining screw is part of the compensator and the movement takes place in the clearance hole in the jaw. In Fig. 18 the compensator is retained in position by a fulcrum pin. It should be noted that in neither case does any pressure come on the retaining device; the pressure is transmitted directly through the compensator to the vise jaw, on which it rests. The examples shown in no way cover the wide range of designs based on this principle.



THE DESIGNING OF MACHINE VISE JAWS



THE DESIGNING OF MACHINE VISE JAWS

A type of swivel jaw very suitable for holding small pieces is shown in Fig. 19. It should be observed that the fulcrum pin is in such a position that when the jaw is closing on the piece it has also a slight downward motion just sufficient to counteract the tendency of the piece to rise. Another swivel-piece jaw is seen in Fig. 20. With this device the work may be depended upon to thoroughly bed itself against the bottom and opposite side.

In Fig. 21 is shown the application of a gage *A* for setting the work in the vise; it is attached to the jaw itself. After the work is set correctly the gage may be swung on one side out of the path of the cutter, as indicated by the dotted lines, and as easily brought into position again for setting the next piece.

In Fig. 22 is seen a vise jaw of a more complicated nature, but of very wide application for holding pieces of delicate form, where gripping them in the ordinary way would cause distortion. The hardened pins *A* are held out from the jaw by the flat springs *B*. When it is seen that all these pins are in contact with the work, they are locked in position by the clamping pin *C*, running through the jaw. The vise is then tightened down on the piece in the ordinary way.

It is very necessary that the special jaws described above should be fitted to the vises in a rigid and workmanlike way. Most of the vises on the market are provided with means for doing this. Care should be taken that the hardened jaws are perfectly flat and bed all the way along on their supporting surface. Any burrs on the tapped holes should be removed, and the corners at the bottom of the jaw should be of sufficient radius to make sure that they are not touching at the bottom and top only, as shown in Fig. 23.

To get this perfect fit, which is so necessary to eliminate all spring and insure the job being held squarely, hardened jaws should in all cases be ground. Not only is a higher-class finish given to the work held in rigid jaws, but faster feeds and speeds and less broken cutters more than compensate for extra workmanship here.

The material generally used for vise jaws is machine steel, case-hardened. Where the number of the pieces to be machined, or the design of the jaw warrants it, it is advisable to use tool steel, hardened. Cast iron may occasionally be used, but when using this material, it is necessary to design the jaws considerably thicker.

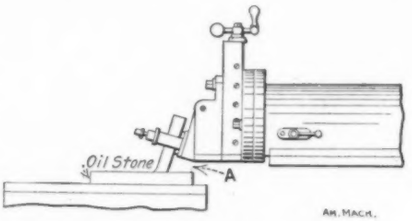
Proper Clearance for Cutting Tools

BY CHARLES H. FRANKLIN

Few machinists or tool makers have not, at some time or other, felt the need of an accurate and reliable method by which they could obtain the proper clearance on the cutting edges of shaper or planer tools and still be sure (without several trials) of a smooth, clean cut, and free from chatters. This problem, of course, is more troublesome with the broad-nose tools, especially the cutoff or parting tools in steel, and the broad-face finished tool in cast iron.

For many years I have taught and advocated the following simple method to obtain the best results:

Take an approximately flat and parallel oilstone and lay it on any available surface, which is in line with the travel of the tool on a shaper, or in line with the bed of a planer, now adjust the tool (using the elevating screw) so that the tool is about $\frac{1}{16}$ in. lower than the surface of the oilstone. Raising the clapper box, place the oilstone under the tool; then with a slight pressure on the stone, draw it toward you five or six times, raising the tool each idle trip back, so as not to cut into the stone, adjust the tool to the work and proceed to cut. After a few trials a mechanic will soon become familiar with the scheme, be able to roll up a chip on steel and have a smooth, clean surface on the work free from chatters. The operation is performed in less time than is required to explain it. The opening *A* on the chatter box in the diagram is greatly exaggerated for obvious reasons.



PROPER CLEARANCE FOR CUTTING TOOLS

In the United States, for obvious reasons, peat had received but scant attention, except at the hands of a few widely scattered experimenters, until the winter of the year 1902-3, when the memorable long-continued strike of the miners in the anthracite regions of Pennsylvania brought a large section of the country to a realizing sense of its almost complete dependence on that group of men for its supply of fuel.—*Bulletin, Bureau of Mines.*

Direct and Indirect Costs

By J. Edtterson*

The plant engineer is more particularly concerned with the direct cost of production and less so with the material and indirect charges.

*Assistant Naval Constructor, U. S. N.

The cost of a job is made up of three components: 1 Material; 2 direct labor; 3 indirect labor. It is desired to show, from the plant superintendent's standpoint, that the direct-labor cost is the most important of the three and the one of which he must have the most intimate knowledge and which at all times must be available. By the plant superintendent is meant that officer of an organization who has a plant under direction, from which he is required to produce work.

Referring to Material Charges

It is at once apparent that the cost of material is not controlled by the plant superintendent, but rather by the designer, customer or maker of the specifications which the plant superintendent is required to meet. So far as the plant management is concerned, the material cost is a fixed one. In general, as regards material, you get just what you pay for.

Considering the indirect charges against a job, it is to be noted that of late great stress has been laid upon the necessity of determining the indirect charges most accurately, and if an accurate, absolute cost of the job is required for estimating or selling purposes, this is necessary. This is of vital importance to the establishment where the value of the indirect charges may be the determining factor in the award of a contract. Thus it happens that commercial firms are sometimes influenced to swing a portion of their indirect expense from that class of their production upon which they must meet competition to that class of their production upon which they have a monopoly. In other cases their inability to determine accurately the cost of articles of production has resulted in a loss of business.

Furthermore, the matter of indirect charges is a most attractive field for the accountant, as the accurate distribution of them offers a very interesting problem. Likewise, the business manager, the estimator and the salesman are interested in the matter of indirect charges. However, it must at once be apparent that the indirect charges are of very little concern to the plant superintendent. This is best demonstrated by the fact that the greater part of these indirect charges is not under his control; this is evident from a consideration of the schedule.

SCHEDULE SHOWING DISTRIBUTION OF INDIRECT CHARGES

Shop Expense

Under Control of Plant Superintendent	Not Under Control of Plant Superintendent	Partially Under Control of Plant Superintendent
Supervision		Maintenance of shop equipment Maintenance, shop furniture and fixtures Maintenance, loose and hand tools Maintenance of machine tools Maintenance of Elevators Miscellaneous shop expense Power Fuel

Power Expense

Attendants on light and power plants	Maintenance of power plant buildings	Power plant, boilers, flues and stacks
Supervision	Maintenance of substation buildings	Power-plant machinery
	Power-plant piping	Fuel
	Distributing system (heat)	
	Distributing system (electrical)	
	Distributing system (air and hydraulic	
	Water system	
	Substations; motors and accessories	
	Maintenance of tools, furniture and fixtures	
	Power-plant, supplies; oil, grease and waste	

General Expense

Maintenance of miscellaneous buildings	Drafting expense
Maintenance of elevators	Inspection department
Maintenance of furniture for offices	Testing and inspecting
Telegraph and telephone system	Testing and inspecting stores
Maintenance of roads, walks and gutters	Maintenance of testing laboratory equipment
Maintenance of tracks	Handling material not chargeable to shops
Maintenance of railroad rolling stock	Examination of apprentices
Weighing apparatus	
Maintenance of hoisting apparatus ashore	
Maintenance of live stock	
Maintenance of vehicles	
General office expense	
Insurance and depreciation	
Maintenance of sewer system	

Items That Fix Indirect Expense

There may be some difference of opinion as to whether these items have been placed under their proper headings, but the exactness of this is not important for a consideration of the point in question. It is sufficient to say that a large part of the indirect expenses is practically fixed by considerations other than those of plant management; as, for instance, the location of the plant, involving rent, insurance, interest, on capital invested, etc., and further the layout of the plant, the relative positions of the buildings as to convenience, accessibility, etc.; the age and type of machinery and equipment; the extent of such equipment and its layout; the location of the plant as regards the labor and material markets. These and other items are decided by business or military considerations, and are quite beyond the scope and control of the man who is charged with operating the plant.

In other words, we have our navy yards laid out to suit military needs. The location of the plant, the layout and distribution of buildings, the character of the grounds; all these are fixed by military considerations. The conditions are set; the plant superintendent must meet them and work with them, obtaining such average efficiency as he can develop under the circumstances.

Supervisory and Operating Charges

There is a portion of the indirect expenses of the plant which properly comes to the plant superintendent and is controlled by him. This portion may be considered as consisting of supervisory charges and operation charges. Both of these, in the matter of their control, are more clearly allied to the direct charges than to the indirect charges, and are only placed under indirect charges for the reason that it is difficult to assign them to any particular job, as they represent small amounts of labor expended on a great number of jobs. The efficiency of the supervisory force and of the operating force of the plant represents a problem in the handling of direct labor, and neither offers an exception to the statement that the plant superintendent is concerned primarily with the direct charges in his efforts toward efficiency. The supervisory and operating forces are handled exactly the same as the force working on job orders of production.

Maintenance Charges

A reference to the schedule shows that certain of the indirect charges are listed

as being "partially under the control of the plant superintendent." This will, in general, be true of the class known as "maintenance charges." The age and construction of buildings, machines and equipment generally must influence the maintenance charges. This portion is not under the control of the plant superintendent. The proper care of such buildings, machines and equipment may be said to be a part of the duties of such superintendent; but suppose that they do receive the proper care, there will be a certain fixed charge for their maintenance proportionate to their age and proper construction.

In other words, the plant superintendent does not have it in his power to greatly influence the indirect charges. Therefore, he is not particularly concerned with them, and they do not enter into a consideration of the efficiency of any given or established plant. With a plant established, improvement and efficiency must come through a reduction of the direct cost of production.

Having taken the material charges and the indirect charges out of the control of the plant superintendent or, rather having pointed out that they are not under his control, it leaves him only the direct charges with which to obtain his efficiency. The important thing to determine, therefore, is the proper method of recording these direct charges as to form, substance and availability.

Standard Machine Operations

Every job may be divided into certain standard machine operations. The job may never recur, probably will not; but the standard machine operations will continually recur. Therefore, the important thing to determine and record is the accurate cost of these operations. Further, they should be recorded in such form and in such place as to make them comparative, and available for the constant daily use of the plant superintendent. The first step, therefore, is to install a system that will give you these records and make them available. The next step is to study and compare these records. You will then arrive at a determination of your present efficiency.

Then must follow a careful and detailed time-study of each standard operation, breaking it up into such factors as will permit of its analysis. By a time-study of these factors it will be possible to determine wherein time is being wasted or energy lost. Each change in method gives us new records which we can compare with those previously obtained, and the curve of efficiency is readily sketched in and followed. It is to be noted that this can be accomplished only by a consideration of the standard operations and not by a consideration of the job as a whole. Therefore, the plant superintendent is not interested in the cost of the job as a whole. He is interested in the cost of the operations. The job-order number merely connects his work with the work of the accountant.

Recording Machine Operations

There is a disposition to lay too much stress on the cost of the job orders, as the job orders usually issued in navy yards are of such general character as to give no data which are valuable for comparative purposes. It may be argued that these job orders should be issued in such detail as to make them comparative, buf this is quite impracticable, as issuing a separate job order for each machine operation is necessary under it. Let the job order be quite general in reading if you so desire, and let the detail be in the form of "instruction cards" to machines or operators, and having preserved these "instruction cards," file them away according to classes.

You thus at once have the desired record of machine operations. For instance, it is only of general interest to the plant superintendent to know the cost of installing a bulkhead on the U. S. S. "Illinois," for the reason that when bulkheads are installed on any other ship the cost of the installation on the "Illinois," furnishes him no guide to efficiency, as there is no probable chance that any two bulkheads will be alike; but if he obtains a record of the cost of laying out a certain number of plates per bulkhead on the "Illinois," of drilling a certain number of holes, of driving a certain number of rivets, of calking a certain number of feet of seam, of painting a certain number of square feet of bulkhead, he can readily compare these operations with other operations of their class, whether they be performed on bulkheads, on decks, on bridges and side plating, or upon any other job.

If he desires to install bulkheads more efficiently, he attacks the problem by first taking his laying-out gang, studying their process, and guiding them toward greater efficiency. Then he takes his drilling gang; endeavors to increase the number of holes that can be drilled per day, per hour, or per minute. Then he attacks the problem of riveting and endeavors to increase the number of rivets that can be driven in a day. Then the problem of calking, of painting, etc., treating each operation separately, analyzing it, studying it, devising improved methods for performing it, eliminating delays, lost motion, and all that tends toward inefficiency. Greater efficiency on a job is thus obtained by improving the efficiency of the separate operations. Take care of the operations and the job will take care of itself.

Whatever system is installed, therefore, must be such as to enable the plant superintendent to attack the operations. Such a system must provide for the division of jobs for the standard operations; for issuing instructions to the men or mechanics covering these standard operations; for recording the time spent by the men or machines on these standard operations; for filing these instruction cards by classes, so as to permit ready reference and comparison; for detailed study of these operations. These are all merely a part of proper or scientific management.

Labor Records and Job Orders

What has preceded is intended to illuminate and lay particular stress upon the following two very important points incorporated:

The relative value of indirect and direct labor records, from the standpoint of the plant superintendent. There can be no question but what the plant superintendent has merely a general interest in the indirect charges and a vital and constant interest in the direct charges.

The very small importance of the job order, from the standpoint of the plant superintendent, and the extreme importance of the operation, from the standpoint of the plant superintendent. There can be no question either but what the plant superintendent has merely a general interest in the job order as a whole, and a vital and constant interest in the detailed operations. The problem therefore is, how to put the direct labor charges and the operation records in the vest pocket of the plant superintendent.

Density of Aluminum

Owing to the high purity of the present commercial aluminum, as compared with that on the market several years ago, when the density and coefficient of linear expansion were determined for the metal, determinations were recently made by Dr. F. J. Brislee, who reported his results at the sixty-first general meeting of the Faraday Society. The metal used carried 99½% Al, and about ¼% each of Si and Fe. For cast metal the density was 2.708, and for hard-drawn rod, 2.705. Remelted aluminum had a density of 2.68, perhaps due to absorbed nitrogen, as suggested by Dr. R. Seligman. The coefficient of linear expansion for hard-drawn aluminum is

$$L_t = L\ (1 - 0.00002432\,t)$$

for annealed aluminum:

$$L_t = L\ (1 - 0.00002454\,t)$$

The above figures for density are greatly in excess of those currently given, as is also Dr. Seligman's of 2.727 for the density of rolled aluminum sheets.

In describing the notable piece of screw-machine work made on the Cleveland automatic on page 1239 of Volume 34, we inadvertently omitted the time required, which was 45 seconds each.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

A Card System for Checking Tools

This system was designed and put into service in our shop to take care of a condition which obtains in most of the larger shops of the country where there is no plan of keeping tab on the tools that are not generally issued from the tool crib on checks, such as files, scrapers, cold chisels, forged machine tools, oil cans, tool holders, etc. The advantage of such a plan was apparent immediately, as several truckloads of forged tools were dug up that had been stowed away and consequently had not been in service. Most of these were high-speed steel and represented quite a bit of capital.

On a second round, several truckloads of files were brought in, some of which were practically new, and were again put into service. This cleanup was preliminary, after which a tactful man was sent through each department, accompanied by the foreman of that department, and he made a list of all the tools the workman wished to keep, charging in ink on the tool card the tools he wished to keep permanently and leaving checks in the tool crib on the tools he wished to keep temporarily.

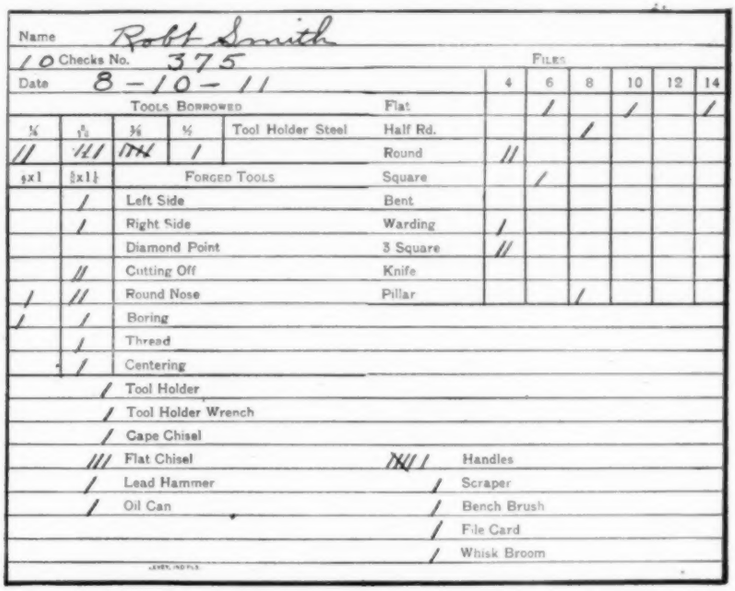


FIG. 1. WORKMANS' TOOL CARD, 6x5 IN.

On this tool card, which is shown in Fig. 1, was also written the workman's name, his factory number, and the number of checks issued to him. The number on his checks should be the same as his factory number. These cards are folded in the middle, the number written on one of the upper corners and filed away in consecutive order in a card index or drawer.

When a workman wishes a certain tool that he cannot obtain on check, he asks his foreman for an order, Fig. 2. This order is presented at the tool-crib window in exchange for the particular tool he wants. The tool clerk files the order with others on a convenient hook. They are taken next morning by a clerk designated for that purpose and the tools are charged on the tool cards. The orders are then sent to the cost department, where the tool department receives credit and the department which ordered the tool is charged with the cost.

In case the workman wants to exchange a wornout tool, the department foreman has a chance to examine it, and if, in his judgment, it can be used longer, he refuses an order for exchange.

A foreman who is working in the interest of his company can save a great many dollars in this particular, especially on files. Should he decide the workman needs an exchange, he writes the order on Fig. 2, marking out "charge" instead of "exchange." These orders go direct to the cost department without being charged on the workman's card.

When a workman quits the employ of the company, he is required to turn into the tool crib all tools charged against him on his tool card, together with the number of checks that had been issued to him, before the foreman of the tool department will issue him a clearance slip, Fig. 3.

It is, of course, understood that the paymaster will not pay anyone off without a clearance slip. Where the workman cannot turn in all the tools and clear himself, he is required to pay an amount which, in the judgment of the superintendent, is a fair price for what is missing.

This system was devised more especially to keep each workman from collecting an enormous amount of useless tools.

Indianapolis, Ind. G. W. LINN.

Tool Dept. 8-10-1911
Please furnish and charge
to No. 375 Dept. 29
1- Rd bas file
Jwg

FIG. 2. SPECIAL TOOL ORDER

NOTICE.
Hand this to Paymaster.
Date 8-14-1911
Mr. Robt Smith No. 375
Returned all Tools and Checks.
Signed S. A. H.
Foreman.

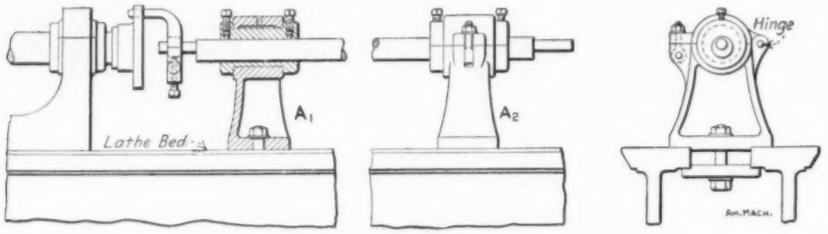
FIG. 3. FINAL CLEARANCE SLIP

Attachment for Turning Eccentrics

We had large numbers of long shafts, as shown, to be machined. These were 1½ in. in diameter by 6 ft. long with an eccentric 1 in. in diameter by 3 in. long at each end. These two eccentric ends had to be exactly true with each other, as well as with the shaft itself, as they fit in bearings, and revolved at a fair rate of speed, thus giving a crank-motion to the long shaft.

To insure correct machining, we rigged up the attachment as shown in the dia-

grams, which give a rough idea of the principle. We made two brackets A_1 and A_2 and fitted these to the bed of one of our engine lathes. These brackets were bored true with the spindle of the lathe, and had loose caps, with hinge and clamp bolt. Fitted to the brackets were brushes,



ATTACHMENT FOR TURNING ECCENTRICS IN ENGINE LATHE

bored eccentric, and so arranged that when the caps were clamped down, these bushes could revolve, but were located rigidly endwise.

The shaft would be placed in position in the bushes, which were then clamped to the shaft by means of the setscrews. When the shaft was revolved, it would be turned as per the dimensions previously given. When this was finished, the two caps would be raised and the whole shaft turned end for end, without unclamping the bushes, or moving them in any way. The second end of the shaft would also be turned now (after fixing in brackets as before), and had to be absolutely true with the other end. By having different bushes, various sizes of shafts and varying eccentrics can be handled. Of course, to insure the whole job being true, the bushes must not be unclamped until both ends of the shaft are finished.

R. DAVIS.

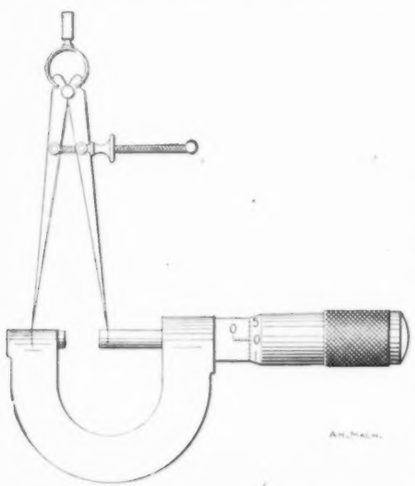
Manchester, England.

Micrometer Lines to Set Dividers

The illustration shows a pair of dividers and micrometers. My idea is to have fine lines at each end of the micrometers to be used for setting dividers for accurrate work. The dividers may be set to any odd distance more accurately this way than with a common scale.

CHARLES HOMEWOOD.

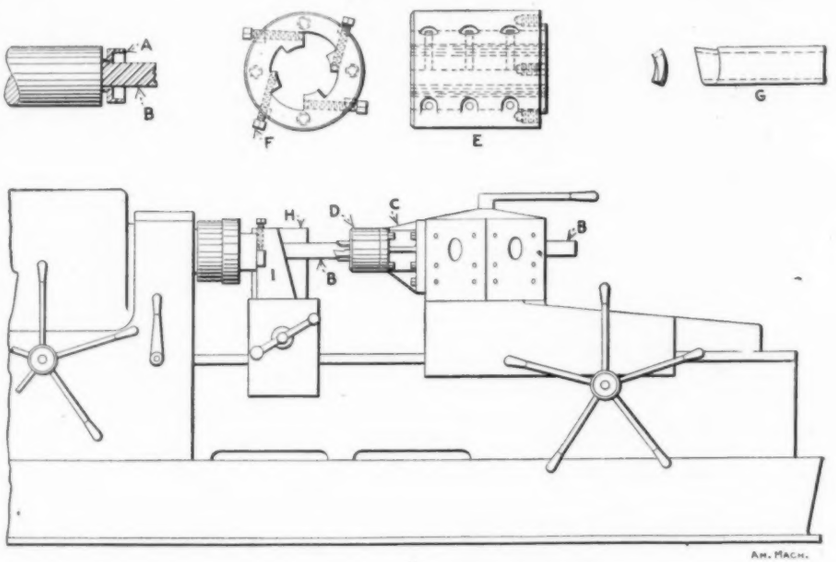
Waterloo, Iowa.



MICROMETER LINES TO SET DIVIDERS

A Ball Cup Trepanning Job

The accompanying diagram shows an interesting ball-cup forming job, the cup being trepanned from 4⅛ in. diameter special, high-carbon steel, at a cutting speed of 85 ft. per minute and under a power feed of 0.018 per revolution, then formed and cut off at 90 ft. per minute, a cutting compound, of course, being used.



A BALL-CUP TREPANNING JOB

A cup formed and partially cut off is shown at *A* the trepanned core *B* 2⅞ in. in diameter is thus saved, cut into lengths of about 24 in. and further utilized in the manufacture of other parts. Thanks to the rigidity of the entire setup, the tools run 12 to 15 hours without regrinding.

A 4½x30-in. Bardons & Oliver turret lathe is used, and at *C* is a cast-iron extension used in order to get the tool nose *D* past the slides and close to the chuck. *E* shows the tool in detail. It is a steel nose carrying four trepan-forming tools of high-speed steel and three setscrews *F*, force each cutting tool down into its seat and also out against the inner wall of the nose, making an extremely rigid clamp, and also one easily adjusted.

One of the tools, shown at *G*, is planed from flat bar stock and not cut from a cylindrical shell as one might think. The outside of the cup is formed by back slide *H* and cut off by tool in front slide *I*, approximately eight minutes being required to form and cut off one cup.

Tarrytown, N. Y. E. D. BRAUN.

Suggestions for Fire Prevention

Your editorial "Fire Risks in Machine Shops," was timely, coming as it did with the laws recently passed, such as the one making throwing lighted matches and cigarettes a misdemeanor. I suggest the following rules with regard to fire-prevention:

The installation of fire-extinguishers conveniently placed; metal receptacles with spring covers for oily waste; sheet zinc under machines using oil, especially screw machines and automatics; systematic refilling of fire-pails.

Brooklyn, N. Y. GEORGE MYERS.

Truing up an Engine Shaft

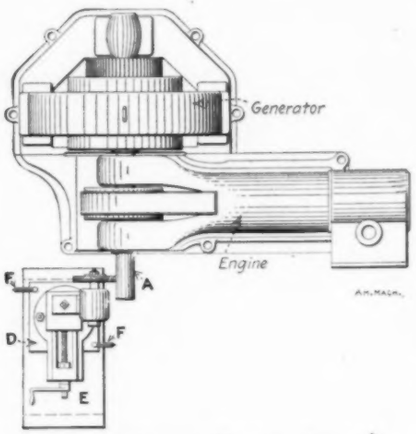
In our power plant we have a direct-connected generator driven by a center-crank engine. The flywheel wobbled and could not be induced to stay tight on the shaft. Thinking it at the danger point, we decided to take it off and investigate.

We found that the side oscillations had pounded the shaft until it showed a belly of about 0.020. The only way to repair this was to bore and bush the flywheel and true up the shaft, which we did in the following manner:

The flywheel was sent to a job shop, where it was bored and bushed with a

steel bushing. As we had other electric power, we converted the generator into a motor and disconnected the connecting rod of the engine.

We made a bench *E*, took the vertical slide off our planer *D* and fastened our



TRUING UP AN ENGINE SHAFT

electric center grinder to this. The slide was clamped to the bench *E* by clamps *F F;* and a couple of two-by-fours braced from the ceiling held all down. After alining the slide with the end *A* to be ground, we were ready to proceed. It took two hours to rig up and about the same time to finish the shaft. As it would have taken at least two days to take the shaft out and do this job in a lathe, we felt that we had done a very good job.

Detroit, Mich. F. C. MASON.

An Expanding Arbor

Tools for rapid production, whose utility is most appreciated in the shops, are those that are simple in construction and easily operated. One of these is the expanding arbor.

Such an expanding arbor is shown in Fig. 1. Here *A* is a tubular cast-iron body with a flange *T* on one end, which is drilled and countersunk with four holes for bolting to the faceplate of the lathe. This body *A* has six slots *H* to hold the blocks *I*, each of which has a hardened pin *H* driven into its center, the head projecting slightly above the surface of the block. The opposite sides of these blocks are beveled to fit the bevel on the cones in the interior of the arbor.

In the interior of this cast-iron holder *A* are two tapered or cone-shaped sleeves, one of which, *B*, has a stem *J*, which is tapped to receive the drawbolts *C*. This sleeve *B* also has a pin *M*, one-half of which is driven into the periphery of the sleeve *B*, as shown in Fig. 1, and the other half slides in a slot cut in the body *A*, the function of which is to prevent the sleeve *B* from turning when the drawbolt *C* is turned.

This drawbolt *C* has a collar *O* pinned to it by pin *P*.

On this drawbolt *C* is another conical sleeve revolubly fixed to the drawbolt *C* and held against the collar *O* by the pin *R* fast in the drawbolt *C*.

In the operation of this arbor, as assembled in Fig. 1, when the drawbolt *C* with the rotatable sleeve *S* is screwed into the sleeve *B*, the two cones approach each other, and, in their approach, force outward the six blocks with their hardened pins, which grip the piece to be held perfectly central and with absolute security. On reversing the motion or unscrewing the drawbolt *C*, the piece is released.

Plainfield, N. J. A. C. CLAIRE.

Why Not Standardize Shanks of Straight-Shank Drills?

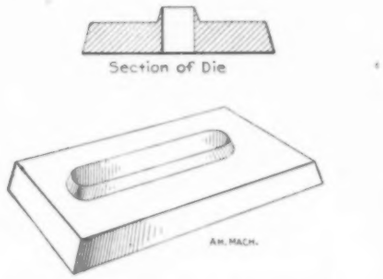
It occurs to me that the necessity for carrying a large variety of collets or chucks, due to the fact that shanks of straight-shank drills are not the same size as the drill, could be obviated by standardizing the shanks, somewhat like taper shanks; that is to say, have a number of sizes of drills with the same size shank.

This necessity was emphasized by the time lost in changing collets, or chucks, and the extra expense of carrying a large and variously sized stock of both.

Richmond, Ind. E. D. F.

Die for Punching Celluloid

Having a number of celluloid coverings for pocket-knife handles to get out of sheet stock for a special job, we tried to punch them with an ordinary blanking



DIE FOR PUNCHING CELLULOID

die and punch. We found that owing to the soft nature of the material the punchings came out with a deep channel around the sides. As the die was the exact size of the finished piece, these were useless.

As the stuff would not shear clean, we tried cutting it. To do this I annealed the die and cut it down around the hole, leaving a ridge ¼ in. deep by $\frac{5}{16}$ in. wide at the base. I filed this down to a knife edge, and, after hardening, ground it to a cutting edge.

For the punch I used a piece of $\frac{7}{8}$ x 2½-in. steel, long enough to cover the hole, and soldered a piece of thick sheet copper to the face of it to prevent injury to the cutting edge of the die. The stroke of the press was adjusted to allow the copper face to touch the die lightly. This tool was easily and quickly made and gave good results.

Hartford, Conn. M. QUAD.

Simple High Speed Countersink

Having use for a countersink with removable cutters of high-speed steel and not being able to obtain anything suitable, I made a cutter of the design illustrated.

The holder is all made of machinery steel. Part *A* is made with suitable straight or taper shank to fit chuck or socket while in operation; the threaded portion is to receive the collar *B*, which acts as a stop for the inserted blades, and can be removed if it is found necessary. Toward the end *A* is tapered as

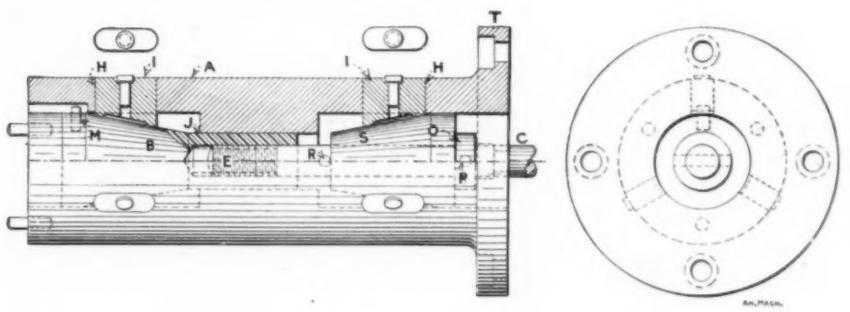
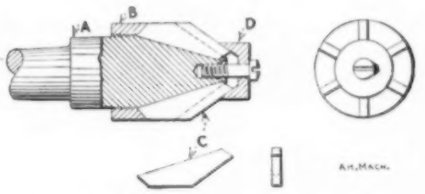


FIG. 1. AN EXPANDING ARBOR



SIMPLE HIGH-SPEED COUNTERSINK

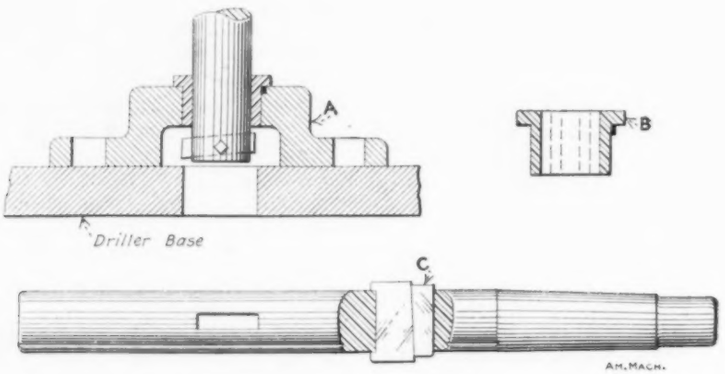
shown, and with slots cut into it to receive the blades *C*. The number of slots is a matter of practice. On the end *A*, and screwed fast to it (either as shown or with flat-head screw), is a button *D*, which acts both as the pilot and the means of keeping the blades in position against the collar *B* and part *A*. The blade *C* is shown in detail and is nothing more than a piece of the required material shaped up and very easy to make.

GEORGE COOPER.

Philadelphia, Penn.

The Radial Driller as a Boring Machine

Any good radial driller, or plain driller for that matter, may be converted into a boring machine for boring out pieces that are too awkward or unwieldy to handle in a lathe or regular boring mill, by simply boring out a hole in the base of the driller and inserting a hardened-steel bushing as a guide for the boring bar.



THE RADIAL DRILLER AS A BORING MACHINE

Having decided on the position of the hole for the bushing, drill through, then bore out with a short, stiff boring bar, using a guide, as shown at *A*. A set of hardened and ground bushings like *B* should now be made to fit the hole just bored; three bushings with bores ½, 1 and 1½ in. in diameter making a good set for all ordinary purposes.

To match the bushings there should be three boring bars with the pilots an accurate sliding fit in the bushings with which it is to be used. Three cutters should be used with each bar; that is, two cutters held in the bar as shown at *C*, and a floating cut to finish to size.

The first of the fixed cutters roughs out to within $\frac{1}{16}$ in. of size; the second to within $\frac{1}{100}$ in. and the floating cutter exactly to gage. This floating cutter is, as the name implies, free to move in the bar, and will follow any variations in the spindle. It must be an accurate fit in the slot in the bar.

Forest Gate, Eng. J. A. GRAY.

A Problem in Angular Machine Parts

In the manufacture of machine parts we have encountered a problem which I thought might be of interest.

It was necessary on a certain machine part to grind a surface which was 0.250 long and at an angle of 30 deg., as represented in the above figure by heavy lines, so that the distances x plus y would equal 0.270.

The solution of the problem is as follows, the unknown distances being represented by x, y and z.

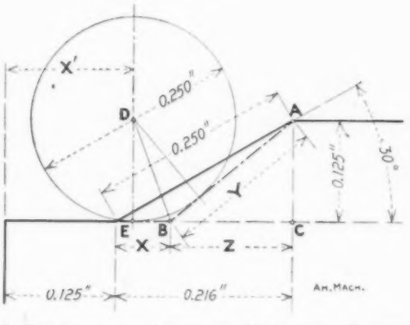
$$x + y = 0.270$$
$$x + z = 0.216$$

subtracting

$$y - z = 54$$
$$z = y - 54$$
$$z^2 + (125)^2 = y^2$$

substituting the value of z

$$(y - 54)^2 + (125)^2 = y^2$$
$$y^2 - 108\,y + 2916 + 15{,}625 = y^2$$
$$108\,y = 185{,}410$$
$$y = 0.1716$$



A PROBLEM IN ANGULAR MACHINE PARTS

$$x + 1716 = 0.270$$
$$x = 0.0984$$

$\frac{0.125}{y} = \frac{0.125}{0.1716}$ = *sin. of angle ABC* or 46°45′

180° − 46° 45′ = *angle ABE* or 133° 15

½ of 133° 15′ = *angle DBE* or 66° 37′

cotan. of 66° 37′ × 0.125 = *EB* or 0.054

$(125 + x) - 0.054 = x' = 0.169$

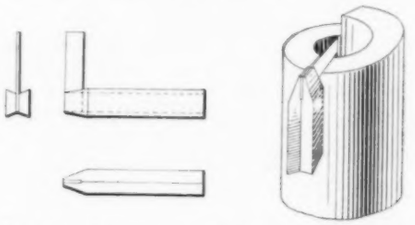
or distance from side of piece to center of plug, used for locating surface.

S. CLIFFORD.

Germantown, Penn.

A Special Angle for Machining Curved Surfaces

The accompanying diagram shows an angle that can be used to advantage in making the curves of round, oval or similar work. If, for example, a curve is to be machined on a turned hollow piece, the angle is placed against the hollow body, with the leg that has an obtuse angular groove applied parallel to the outer edges and with the thin leg radial. The angle itself is shown in Fig. 1, while Fig. 2 illustrates a use for it. In the pattern shop, as well as the fitting shop, the angle will be found to be very serviceable.



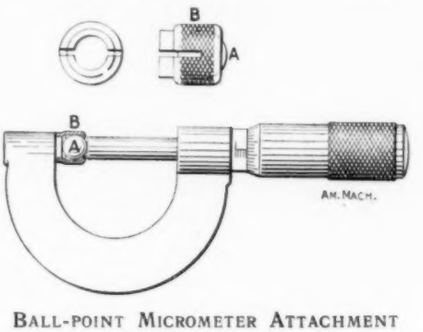
SPECIAL ANGLE FOR MACHINING CURVED SURFACES

K. G. KRATZ.

Chemnitz, Germany.

Ball Point Micrometer Attachment

The diagram shows a ball-point attachment for a micrometer, which is easily made. *A* is ¼-in. steel ball and *B* is turned from drill rod. Bore the top end of *B* large enough to let ball drop in and bottom end 0.002 in. under size of micrometer anvil, then split as shown, put the ball in place and spin edge over as shown.



BALL-POINT MICROMETER ATTACHMENT

This attachment will be found very handy for measuring the thickness of tubing walls or any place where it is desired to measure from a hole to the outside of a piece of work.

A. W. MASSECAR.

Buffalo, N. Y.

Two Planing Operations

By C. A. Rogers*

The illustrations show some planing operations. Fig. 1 shows a method of planing a toggle-joint section, there being four such pieces in each machine.

The work is mounted upon an arbor, which is placed between index centers, blocked up some distance above the planer platen. In order to allow the piece to swing free of the rail and saddle as it is rotated for successive passes under the tool, the latter is carried in a bent holder projecting the full width of the work from the clapper block. A fixture is shown in Fig. 2 for planing a string of box heads of the form and dimensions represented by Fig. 3.

In the position shown in Fig. 2, three tools are in operation at once, although the side head cannot be seen in the view.

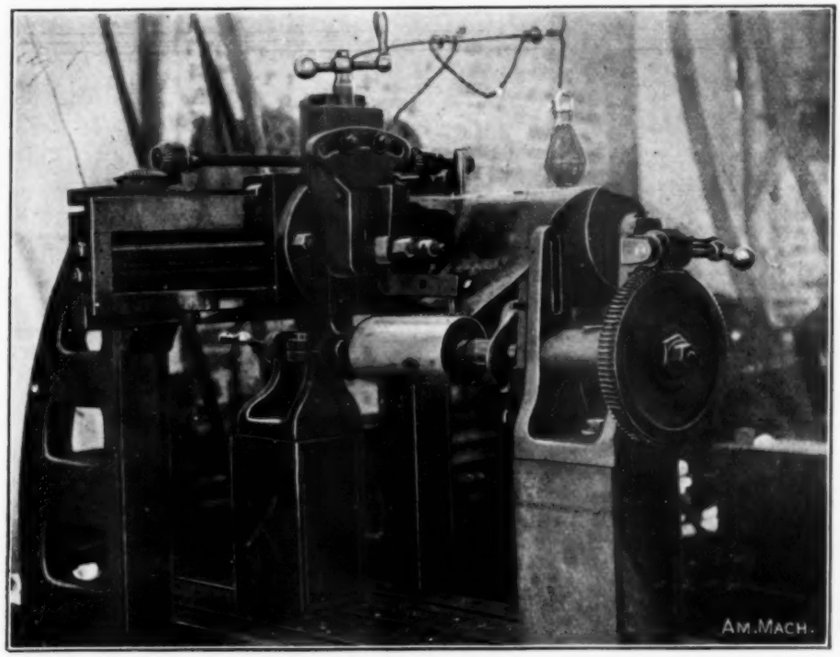


Fig. 1. Planing a Toggle Arm

Fig. 2. A String Planing Job

The string of pieces is first placed on the fixture with the face *A*, Fig. 3, down. With the work in this position, the side head planes off the face *B* and one of the heads on the rail planes the faces *C*. The string is then placed on the fixture with the face *B* down, while face *A* is planed with the side head and faces *D* and *E* with the heads on the rail. Next the pieces are turned around on the fixture and the finished face *A* is brought up against the stope in the fixture, which insures their being square. At this setting, faces *F* are planed with one top head and the side head.

The total time for the planing of the string of work shown is one hour and forty minutes. The limit of variation allowed in all dimensions is 0.001 in. The material is gray iron with $\frac{3}{16}$ in. stock to remove.

*Superintendent, Enamel Concrete Co., Des Moines, Iowa.

Westinghouse Air Spring

A pneumatic cushioning device to take the place of springs on motor vehicles has recently been placed upon the market by George Westinghouse, according to an announcement just issued by the inventor. The new air spring is intended to take care of the greater stresses imposed by the higher speed of the motor vehicle, the difficulty being with the usual elliptical spring that springs made stiff enough to withstand the load imposed at high speed are too stiff for the best comfort at any speed.

The riding qualities of cars equipped with the air spring alone, it is said, are all that can be desired, but a method of supplying it in combination with steel springs is more convenient, particularly when applying it to cars already in use with steel-spring equipment. The cushioning effect of the combination is far more satisfying than that of the air spring alone.

The air spring consists essentially of two hollow cylinders, or cups, sliding one within the other. The open ends of the two cups are placed toward each other, so that they form together an enlarged capsule inclosing a volume which becomes smaller or larger as the two members are telescoped together or drawn apart.

The first problem to be met in making such a device practical is that of air leakage. This must be reduced to a practically negligible minimum; otherwise the necessity for frequent renewal of the air content would become a serious nuisance. The difficulty of doing this is at once apparent upon considering that in four 3-in. cylinders, say, in a car of 3500 to 6000 lb. weight, the air pressure is 125 to 200 lb. per sq.in. with the car standing and becomes much higher when the springs are further compressed with the car in motion over the rough roads.

The first step in eliminating the air leakage was to fill the lower part of the capsule with oil. The upper cup, of the pair making each spring, slides inside the lower cup; thus any leaking air must pass around under the lower edge of the upper cup and up between the two cyl-

inders. By making the depth of oil sufficient to cover the open lower end of the upper cup in its highest position, the cushioning chamber is at all times oil filled. This only means, however, in view of the high pressure, that there is oil leakage instead of air leakage to be prevented.

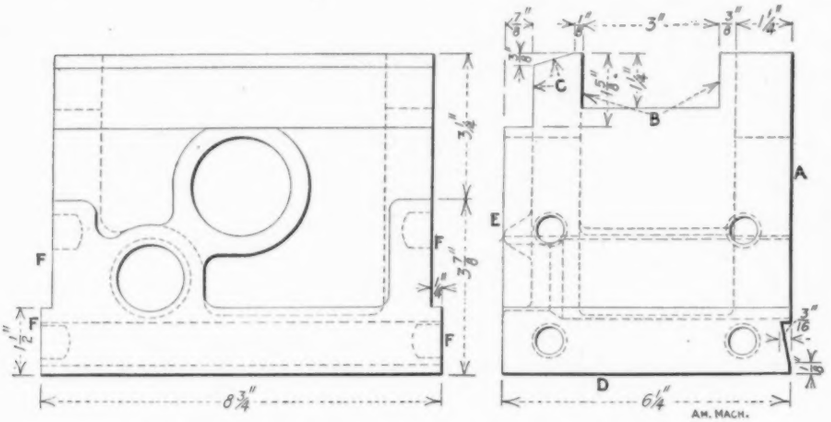


FIG. 3. DETAILS OF WORK SHOWN ON THE PLANER IN FIG. 2

The most important feature of the invention, therefore, is the ingenious device whereby the leakage of oil is reduced it is claimed practically to zero.

Besides its usefulness as a device for reducing the oil leakage, the dasher serves another important purpose. By its movements up and down through the oil which dashes past at increased velocity through the constricted opening, a dashboard effect is developed which damps the vibration of the spring like the mechanical shock absorber used with ordinary springs.

The action of the air spring can be regulated to suit the requirements of the user by changing the initial air pressure or by varying the depth of oil on the cushion chamber. The initial air pressure of the desired intensity is obtained with an ordinary tire pump connected to an air valve.

The air spring will be manufactured by the U. S. Rapid-Fire Gun & Power Co., of Derby, Conn. The springs will be made in three sizes, with cylinders of 3-in. diameter for cars weighing 3500 to 6000 lb., 2½ in. diameter for 2500- to 3500-lb. cars, and 2-in. diameter for lighter cars.

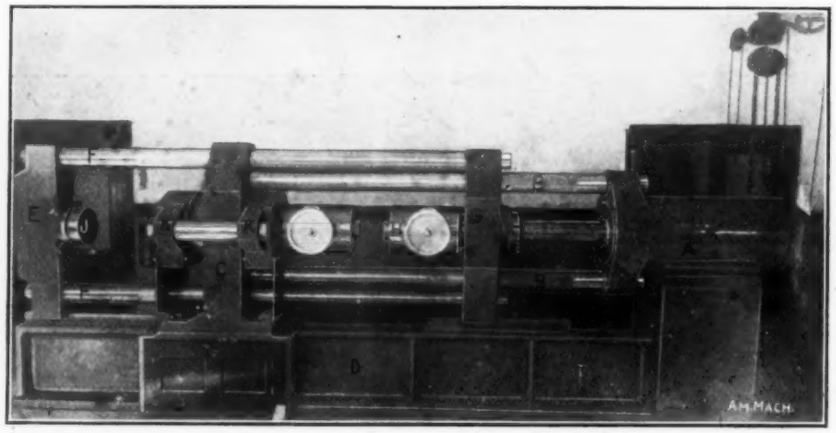
Numerous tests have been made on the air springs which have proved, as explained by the inventor, that the annual saving in wear and tear on the car, and especially on the tires, will almost equal the first cost of the equipment.

Over 20 million dollars' worth of automobiles were exported from the United States in the calendar year 1911, or 20 times as much as a decade ago. The exports to foreign countries last year, including tires and other parts, were valued at $21,636,661.

A New Hydraulic Testing Machine

SPECIAL CORRESPONDENCE

The accompanying illustration shows the straining portion of a testing machine being built by A. H. Emery, of Stamford, Conn., for the National Bureau of Standards, at Washington, D. C. The machine has a capacity of 230,000 lb. for either tension or compression on specimens of any length up to 30 in. It is to be sensitive under all loads up to 2 lb. or less, and accurate to one part in 10,000. The total length is about 18 ft., and the weight of the portion shown about 16,000 pounds.



STRAINING PORTION OF HYDRAULIC TESTING MACHINE

The straining press is of 13-in. bore, 6-in. diameter of piston rod and 30-in. stroke, and is operated by hydraulic accumulators, using either 280 lb. per sq.in. and discharging to the cistern when moving under small loads, or, 2500 lb. per sq.in. and discharging to either the 280-lb. accumulator, or cistern when working under heavy loads. The cylinder *A* is fixed to the main beam by the inner pair of rods *B B*, the main beam *C* being bolted to the bed casting *D*. The cylinder is free to slide as the rods compress when specimens are being loaded, or extend during recoil when a tension specimen breaks.

The vertical crosshead *E*, and the outer pair of rods *F F*, with the crosshead *G*, form a sliding yoke, the rods sliding in bronze bushings with graphite insets, the crosshead *G* carrying a threaded boss on which the tension specimen holder *H* is screwed, and the crosshead *E* carrying the compression platform *J*.

On either side of the main beam *C* is a smaller crosshead *K K*, the one at the right carrying the other tension holder and the one at the left carrying the other compression platform. This yoke is carried on a pair of flexible plates called stay plates, which support and fix it against motion in any direction except one parallel to the axis of the machine. Between the crosshead of the inner yoke and the main beam, which is fixed to the frame, is placed a hydraulic support, which is connected to the scale for weighing the load on the specimen.

From this description and the illustration it will be seen that the load on the piston rod is transmitted to a tension specimen between the two tension holders or to a specimen between the two compression platforms, and by either specimen to the yoke around the main beam and thus onto the hydraulic support. The only resistance to the transmission of the entire load on either specimen, to the support is the load necessary to bend the stay plates for the very slight amount of movement caused by the springing of parts under load, and as this is a purely elastic resistance, it can be allowed for in the rating of the scale.

It will readily be seen that the machine is a very convenient one to use, as no change is necessary when changing from tension to compression specimens. The specimen is in a most convenient position, and this machine being hydraulically operated, the load can be applied at any desired rate and without noise. The construction is such that there is little noticeable recoil when breaking specimens.

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OUTLINE OF TOPICS, PAGE 237

American Machinist

Massiveness in Design

"Machines are designed too light. They are not heavy enough." These and similar statements are heard so often that we accept them as a matter of course, and perhaps half believe them. But we seldom see a design which shows that its originator believed that the best of existing machine proportions are too light, and acting on that belief has deliberately made his heavier.

It is accepted that machine parts—particularly of machine tools—should be designed for rigidity not merely for strength. But there is a third consideration that must not be forgotten, proportioning to eliminate destructive vibration—massiveness.

Thus we have three requirements that many machine parts must meet if wisely designed: Strength, rigidity, massiveness. The amount of metal needed increases in the order given. A part may have ample strength to resist breaking, but deflect so much as to fail to function properly. A change of section, often requiring more metal, is the cure. A part may have ample strength and rigidity but be subject to destructive vibration when in use. A change in design, usually adding more metal, is one cure. We say one cure, for the synchronizing of machine parts is a subject little understood as yet. With the increase of speed taking place in many lines of machines, it is becoming more necessary to study synchronizing effects that produce vibrations.

When a desire to make a machine heavier than others in its class is yielded to, the parts are usually increased a little in size, and everyone is believed to be satisfied. It is, therefore, very much out of the ordinary to find a designer who has had both the courage and the conviction to radically enlarge his proportions. But we recently had the privilege of meeting such a man and seeing his machines in use. They were machine tools. He started with the proposition: "Vibration is the most destructive action to which cutting tools are subjected." Then he proceeded to design to eliminate vibration—to develop massive parts.

The result is lathes—or better, turning machines for they do not resemble standard types—with spindles of the same diameter as the maximum diameter to be turned; millers with spindles as large or larger in diameter than the largest milling cutter used on them; and heavy box-beds filled with concrete to add mass.

These proportions have not been followed out in an isolated machine here and there, but are embodied in many machine tools—of course, special in their application. Some have been running for a number of years, thus proving the sanity of the design. It must be admitted that a 16-in. spindle on a 16-in. turning machine, and an 8-in. miller arbor carrying a 6-in. cutter are startling proportions to one accustomed to the ordinary run of things.

Two principal advantages are apparent: Increased life of the cutting tools between grindings, and negligible repairs on the machine parts. We hesitate to give any of the records showing the increased life of the tools, fearing that some not easily distinguished factors may have aided in producing results that are astonishing. Freedom from repairs is easily believed for such machines. A single example was a 16-in. pulley lathe that ran continuously for six years without repairs. Massive design means durability.

A point worth noting is the flywheel effect of huge spindles. A tool stalls where the casting or forging is hard, where there are lumps, where there is excessive finish due to swelling in a soft mold, and the like. The stored energy in a massive spindle is available to carry the tool over these hard spots and places of excessive finish. The slowing up, grinding action on the cutting tool is done away with.

The shock needed to awaken anyone familiar only with current practice to the requirements of massiveness is shown by this incident: The shop manager who is responsible for the machines mentioned, was at work with his chief designer. The designer had made a layout from sketches and instructions. But it lacked meat; it lacked weight. The manager after looking it over and making suggestions, finally asked the designer to put on his hat and coat and come for a little walk. They went to the foundry yard and stopped before the pig-iron pile. Said the manager:

"There, do you see all that pig iron? That belongs to us; it is cheap. Now go back and use all you want of it."

Perpetual Patent Applications

Among the bills before the present Congress is H. R. 8388, a bill aiming to correct a frequently discussed abuse in the patent system. It provides for a change in the law by reducing to six months the period within which an application shall be completed and prepared for examination or within which the applicant must prosecute the case after an action by the Patent Office.

The object is to reduce the practice of prolonging the life of a patent, or possibly what is more correct, postponing the beginning of the life of a patent by waiting after each action of the office until the legal time limit has nearly expired.

Years ago when the period was two years the commissioners complained to Congress that applicants were using the law as a means of prolonging the life of their applications. One commissioner endeavored to so frame a rule of practice that the time was practically reduced to six months. As there were grave doubts that anyone other than Congress could reduce the period, a section was introduced into a bill which made several changes in the patent laws, providing that the time limit should be reduced from two years to six months. The House passed the bill but the Senate changed the period to one year and the House later concurred. This was in 1897 and since then the period has remained at one year.

There continues to be complaint nevertheless that applications are deliberately dragged out by postponing action until just before the expiration of the year allowed. Cases are cited where patent applications

have been in the Office for fifteen years and when granted were in force for seventeen years from their date of issue. The most notable case of this kind was the Selden automobile patent now on appeal to the Supreme Court. It was applied for in 1879 and issued in 1895. It expires in 1912, thirty-three years after its application. When the litigation was in the lower court the judge said:

> The claims were reworded and the specification amplified many times, and usually, after a rejection made or criticism offered by the examiner. Selden did nothing by way of amendment or reply for about two years—the extreme limit of inactivity permitted him by the then rules of Patent Office practice. By these means he received in 1895 a patent for an invention of 1879, and in the meantime had never built a motor car, and never succeeded in getting anyone sufficiently interested in his theories to experimentally try them out with larger means and better mechanical ideas than Selden himself had. . . . No litigation closely resembling these cases has been shown to the Court, and no instance is known to me of an idea being buried in the Patent Office until the world caught up to and passed it, and then embodied in a patent only useful for tribute. But patents are granted for inventions. The inventor may use his discovery, or he may not; but no one else can use it for seventeen years. That seventeen years begins whenever the United States so decrees by its patent grant. That the applicant for patent rights acquiesces in delay, or even desires delay, is immaterial to the courts, so long as the statute law is not violated.

There is another class of cases which adds to this condition of affairs. Lawyers do not like to admit failure and furthermore are sometimes paid only in case a patent is secured. While there is life there is hope and a case which they are unable to have allowed may be kept alive in the hope that a future examiner may not be so strict or that some way will eventually be discovered to squeeze the case through even though the claims may be long and worthless. One cannot help sympathizing with this practice in some cases, for occasionally an examiner lacking in proper breadth of mind will persist in sticking to a poor decision because he dislikes to admit he was wrong.

It is assumed that the proposed law reducing the period from one year to six months would make it twice as hard to drag out applications in the Office. But there are those who hold that six months would be a real hardship in some cases, and hence considerable opposition to the bill is anticipated.

There is some objection that will be difficult for the Office to meet. The Patent Office itself is not so prompt and accurate in its work that it can with consistency be too strict with others. Some of the actions and rejections made by the Office are poorly done and the references cited are hopelessly inadequate. Considerable more time than would otherwise be required is necessary to prove to the examiner that de does not know what he is talking about and to tell him so in such a way that he is kept in good humor.

The length of time the Office takes in acting on amendments is usually from one to two months. When an amendment is filed in reply to an action by the Office there may be some unintentional error on the part of the attorney which would lead the examiner to declare the amendment not to be a proper one. If an amendment is filed just before the time limit expires the examiner does not act on the case until after the limit. It would then be too late to correct the error. In other words, in order to be on the safe side a case should be amended in time to permit the examiner to act, and in the case of an insufficient amendment to permit the applicant to correct the error, all before the time expired. This means that if a six-months rule is in effect action should be taken within three or four months. Where the attorney is busy and perhaps has to carry on correspondence with the applicant over long distances such as to a foreign country, the rule would be a serious difficulty.

It must be admitted though that if no other means is devised to gain the ends desired the proposed plan may well be said to have greater advantages than disadvantages.

An apparent weakness in this proposed bill is the provision that when it goes into effect it shall not apply to any application filed prior to the date it becomes operative. The applications of an earlier date might be in the Office for ten years after this law went into effect and yet would not be under its provisions. It would be much better to have it apply to all applications and in order that present applications should not be injured through lack of knowledge of the change the bill could go into effect say a year after its passage. The bill has been endorsed and its passage urged by the Commissioner of Patents in his recent annual report to the Secretary of the Interior.

There would seem to be a more satisfactory way to avoid this dilatory practice. That would be to remove the advantage which results from delaying a case. This could to a large extent be accomplished by making the term of a patent 17 years from its issue provided that such term did not exceed 20 years from its date of application. It is always easier to keep a man straightforward by removing temptation than by trying to force him to avoid it by legal provisions.

A Railway Shop in Cuba

In the article published under this title at page 1031, Vol. 35, the machine inadvertently referred to as a vertical spindle guide grinder was in reality a universal lapper and grinder built by Beyer, Peacock & Co., Ltd., Manchester, England.

Schloemann Gear Cutter Correction

In the article "The Schloemann Gear Cutter and Slotter," page 353, the pitches in the table of capacities were given in French modules as 20, 30 and 40, respectively, whereas the circular pitch should have been given as 2½, 3¾ and 5 inches.

The table should have appeared as follows:

Pitch	Depth of Tooth	For cast iron Time	For steel Time
2½	8 in.	6 min.	10 min.
3¾	12 in.	18 min.	27 min.
5	16 in.	26 min.	48 min.

Personals

George von Rottweiler has resigned as chief engineer and factory manager of the Falls Machine Co., Sheboygan Falls, Wis.

R. P. Lamont has been elected president of the American Steel Foundries, Chicago, Ill., in place of William V. Kelley, resigned. Mr. Kelley has been elected chairman of the board of directors.

J. A. Struthers, formerly electrical engineer with Westinghouse Electric & Manufacturing Co., Pittsburg, Penn., has accepted the position of designer for the Henry Manufacturing Co., New York City.

W. T. Clark, formerly with Fairbanks-Morse Manufacturing Co., Beloit, and previous to that with the General Electric Co., is now occupying the position of general superintendent of equipment with the Otis Elevator Co., New York.

James G. Fairbanks has resigned as president and general manager of the Fairbanks Steam Shovel Co., Marion, Ohio. Col. C. W. Fisher, Bucyrus, Ohio, has been elected president to succeed Mr. Fairbanks, and J. E. Marbaugh, Monterey, Ind., has accepted the position as general manager.

H. G. Kiefer, formerly general manager of the Detroit Edge Tool Works, and more recently assistant metallurgist of the H. H. Franklin Manufacturing Co., Syracuse, N. Y., has been made chief metallurgist, in charge of the newly created department of metallurgy of the Timken Roller Bearing Co., Canton, Ohio.

Irving H. Reynolds, for the past seven years vice-president and general manager of the William Tod Co., Youngstown, O., will retire to take up engineering work. Prior to his connection with the Tod company, Mr. Reynolds was for many years identified with the engineering and management of the Edward P. Allis Co., now the Allis-Chalmers Co., Milwaukee.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Relieving Attachment

The special feature of the relieving attachment shown in the halftones is its application not only to all ordinary forms of relieving but to taps and hobs having spiral flutes.

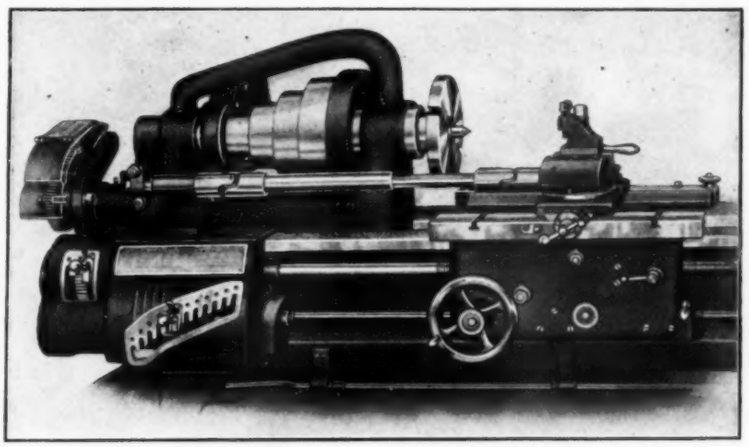


FIG. 1. HENDEY RELIEVING ATTACHMENT

As will be noted in Fig. 1 the actuating mechanism is mounted on the main gear box, displacing the tool pan or its cover. The tool slide interchanges with the compound or other rest on top of the cross-slide, and thus incorporates the advantage of the swiveling feature on the slide

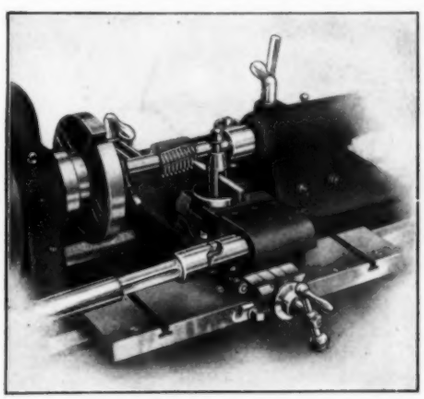


FIG. 2. RELIEVING A SPIRALLY FLUTED HOB

to secure suitable positions for side and end reliefs.

Where it is desired to change the amount of relief from one type of cutter to another the ends of the oscillating shaft and cam lever are provided with a toothed coupling which permits a change in the relative position of the eccentric on the tool slide to the cam lever, thereby lengthening or shortening the reciprocating travel of the tool. This adjustment gives a range of from 0 to approximately $\frac{1}{32}$ in. to the tool slide on 14-, 16- and 18-in., $\frac{1}{16}$-in. on 21 in., and $\frac{1}{4}$ in. on 24-in.

In Fig. 2 the attachment is shown at work on a spirally fluted hob. In relieving spiral hobs or taps the pitch of the spiral and the necessary driving gears are first determined. After the attachment is perfectly geared to suit the spiral and number of flutes, the lead screw is engaged and the backing-off process carried on the same as for straight flutes, care being taken not to disengage the

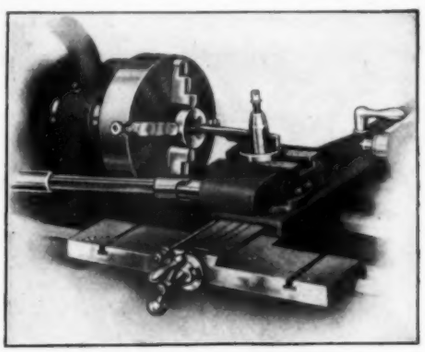


FIG. 3. USING ON INSIDE WORK

lead screw. The carriage is reversed by power, using for that purpose the lever at the right of the apron.

When used for inside work, as shown in Fig. 3, the eccentric controlling travel of the tool slide is set so that the relieving is done away from, instead of toward, the axis of the cutter. The change is accomplished at the toothed coupling of the cam lever and oscillating shaft, rolling the latter beyond the zero mark, clockwise, as much as necessary to get the desired amount of travel in the tool slide.

For inside work it is also necessary to change the position of the opposing spring in the tool slide to prevent the tool from jumping into the work when in the cut. This spring is found in position by removing the tool-slide hood.

The attachment is a recent development of the Hendey Machine Co., Torrington, Conn.

Speed Dial for Motor Driven Machines

The speed dial shown in Fig. 1, furnishes the operator of a machine tool, driven by an adjustable speed motor, of the armature-shifting type, with means

FIG. 1. RELIANCE SPEED DIAL

for determining the speed of the motor, and in turn the cutting speeds.

The dial can be mounted at any convenient point on the machine tool, an example of which is shown in Fig. 2. It is simply necessary that it has some positive connection with the means employed for shifting the armature of the motor. As the armature of the motor is shifted and the gradual change in speed obtained, a pointer moves in the speed dial. The scales in the dial take into account the different gear ratios between the motor and the work, and can be set for different cutting speeds at the cutting tool, depending on the cutting steel used and the character of the work.

The device, therefore, becomes a calculator by which the operator can set the speed of the motor so as to give any desired speed at the cutting tool, taking into account all the variable factors. The

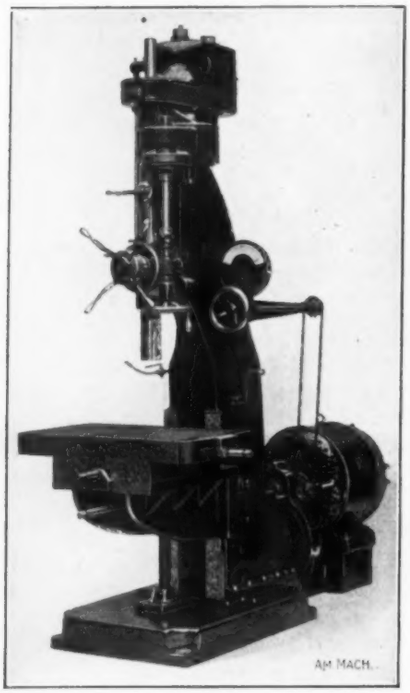


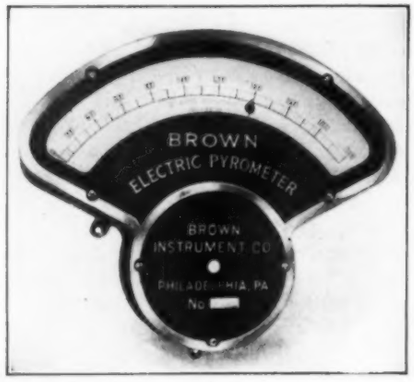
FIG. 2. DIAL SET UP ON DRILLER

dial is set for the cutting speed to be used and then the armature of the motor is shifted in the usual manner until the pointer indicates the diameter of the cut to be taken on the proper scale for the gear combination used.

These dials are furnished properly calibrated for use, with "Reliance" adjustable-speed motors, on various types of machine tools by the Reliance Electric & Engineering Co., Cleveland, Ohio.

A Pyrometer with Illuminated Dial

The halftone shows an electrical pyrometer which has been added to the line of pyrometers manufactured by the Brown Instrument Co., Philadelphia, Penn.



PYROMETER WITH ILLUMINATED DIAL

The scale is 12 in. long. When desired this instrument is provided with a translucent dial illuminated by an electric lamp at the back of it.

This arrangement is very convenient for use in dark shops where hardening and heat treating of steel is carried on.

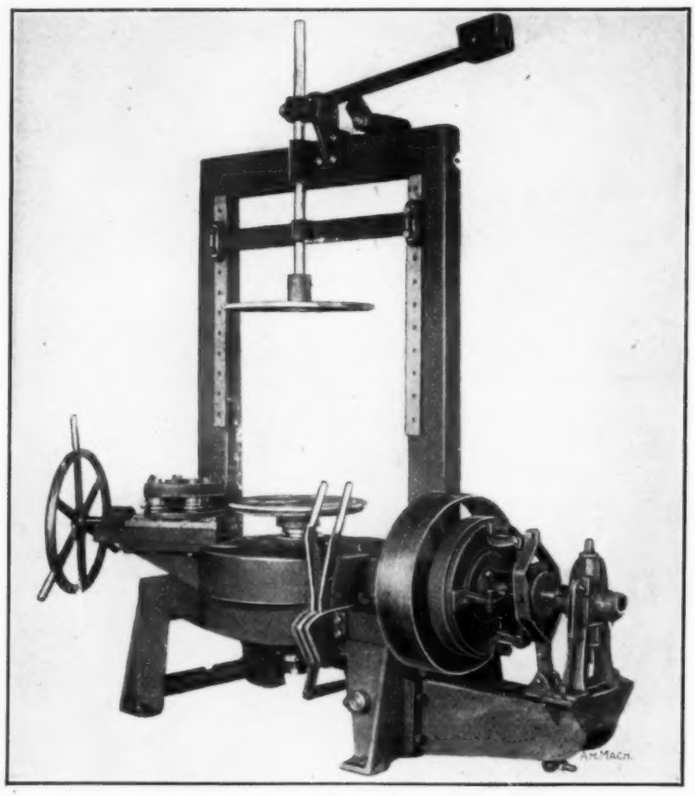
Power Double Seamer

The machine shown in the accompanying halftone, made by the Niagara Machine and Tool Works, Buffalo, N. Y., is particularly intended for double seaming the heads of drums and other sheet-metal packages. The heads must be previously stamped to the proper shape by means of press and dies.

The work to be double seamed is clamped between the top disk and the lower double-seaming chuck, which is shaped to suit the work. The chuck is driven by means of bevel gears, and the spindle carrying the chuck has an adjustable end-thrust bearing.

The carriage with the double-seaming rolls mounted in a turret head is actuated by means of a screw and handwheel. Either two or three rolls are used according to the type of the seam and thickness of the material.

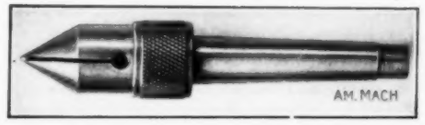
The motion is controlled by a friction clutch actuated by one of the hand levers, and the other lever is used to bring down the upper clamping plate, which is counterbalanced. The seamer will take work from 10 to 32 in. in diameter, and not to exceed 45 in. high. It weighs about 4200 lb.



POWER DOUBLE SEAMER

Self Oiling Male Center

The accompanying illustration shows a self-oiling male center with which the work can be oiled without releasing it, designed to avoid variation in the turning.



SELF-OILING MALE CENTER

The brass collar shown is slid forward after putting the oil in so that the oil is retained and dirt kept out.

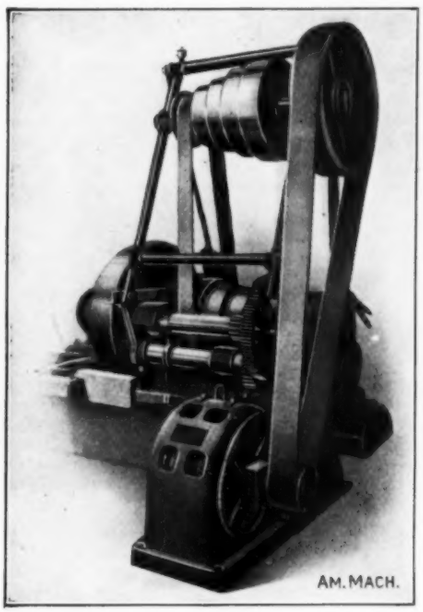
This is a recent product of the Stark Tool Co., Waltham, Mass.

The Burke Speed Changing Device

The Burke Electric Co. Erie, Penn., has developed an arrangement for changing the constant speed of an alternating- or direct-current motor, and delivering

it to the machine at the necessary speed for the requirements of the work.

The accompanying illustration makes the arrangement quite clear. It consists simply of a pipe frame supporting a jack shaft and the necessary pulleys for the speed adjustments, which are belted to the main cone. The Burke company has just placed the new device upon the market but has been trying it out for some time in its own work, where it has operated successfully on the various classes of machine tools, including lathes, shapers, milling machines, etc.

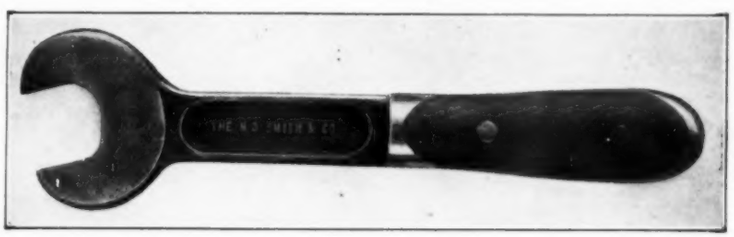


SPEED-CHANGE DEVICE

Of course, the new arrangement will be particularly valuable in allowing the application of alternating-current motors, which are inherently constant-speed machines.

Solid Head Wrench

The wrench shown in the accompanying halftone is drop forged of one solid piece of steel, case-hardened. The opening is milled and the wooden handles locked in and waterproofed.



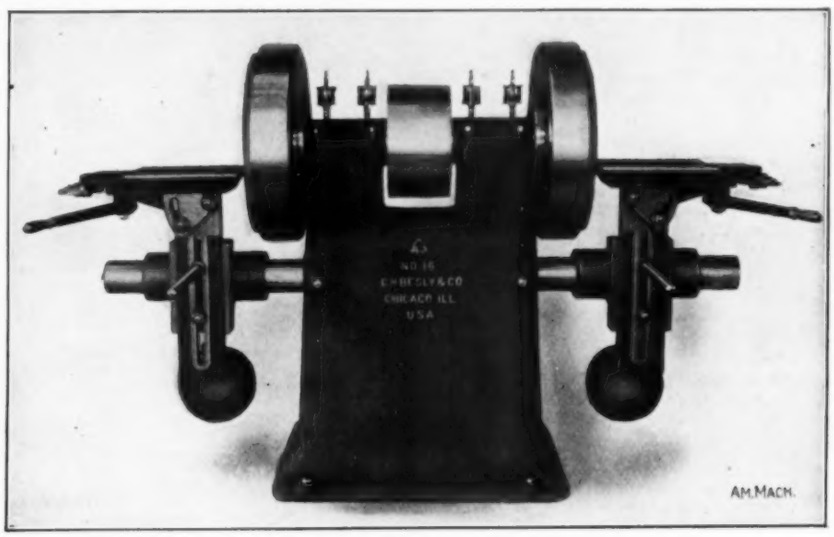
SOLID-HEAD WRENCH

The wrench is made in a variety of sizes by the H. D. Smith & Co., Plantsville, Conn.

A 24-in. Double Ring Grinder

Charles H. Besly & Co., Chicago, Ill., recently placed on the market the grinder shown, which is heavier and more powerful than any grinder heretofore built by this concern.

This machine is equipped with two geared, lever-feed work tables and two pressed-steel ring-wheel chucks holding ring grinding wheels, 24 in. in diameter. It is intended for larger, rougher work than is ordinarily done on disk grinders. The vitrified grinding rings will stand more severe service than the usual emery-cloth covered steel disk wheels.



24-IN. DOUBLE-RING GRINDER

The bare machine as illustrated, weighs over 3500 lb. The geared lever-feed table, which weighs about 600 lb., gives a leverage of 18 to 1. The spindle pulley is 15 in. in diameter for the 8-in. belt and is capable of transmitting over 30 horsepower. The spindle is 3¼ in. in diameter and each bearing is 12 in. long. The rockershaft is 4½ in. in diameter by 7 ft. long.

The end thrust is taken on hardened and ground collars over 20 square inches in area. Each 24-in. pressed-steel ring-wheel chuck weighs 275 lb. and with a new grinding ring, 24x11 in. hole by 5 in. deep, in place weighs 415 lb.

The machine will rough $\frac{1}{16}$-in. stock off the bottom of a sad-iron casting in about ten seconds, and the feeding pressure on the surface being ground is approximately 100 lb. per square inch of area.

Snap-on Reflector Lamp Shade

The snap-on reflector lamp shade shown in the illustration is designed to fit any standard lamp with or without a guard. It is snapped on instantly and adjustable to any position.

The shade is variously made of bright tinplate with the outside painted green, polished nickel plate or brass. These reflectors are manufactured by the Universal Stamping Co., Buffalo, N. Y.

SNAP-ON REFLECTOR LAMP SHADE

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

The Troy Scale Co. has secured an option on the plant of the Bennington Machine Works, Bennington, Vt., and will move its plant there shortly. The Bennington, Vt., Board of Trade has charge.

W. B. Fenel, Boston, Mass., manager of the New England branch of the Oldsmobile Co., will erect a three-story garage and salesroom, at Beacon St. and Commonwealth Ave.

The Olds Motor Works, Lansing, Mich., will erect a new three-story building in Boston, Mass.

The addition to the works of the Heald Machine Co., Worcester, Mass., has been completed.

The main building of the Wollaston Foundry, Wollaston, Mass., owned by A. A. Lincoln estate, was practically destroyed by fire, Feb. 27, with loss of $15,000.

The M. S. Wright Co., Worcester, Mass., manufacturers of frame hardware and vacuum cleaners, at 51 Jackson St., has added a third floor to its plant and increased its employees.

Fire and water damaged the machine shop of the mill owned by C. H. Dexter & Sons, at Windsor Locks, Conn., Feb. 25. Loss, $10,000, covered by insurance.

MIDDLE ATLANTIC STATES

Fire destroyed the St. Nicholas Garage, at 54 West Sixty-seventh St., New York, N. Y.

The Navoe Auto Co., which recently started making gasoline engines, in Norwich, N. Y., now has plans for adding to its building and equipment this spring.

The Mott Wheel Works, of Utica, N. Y., has increased its capital from $150,000 to $300,000, and plans to build a new factory building.

The New York Central & Hudson River R.R. has awarded a contract for the construction of a car shop, at West Albany, N. Y., to cost about $100,000.

The General Vehicle Co., Long Island City, N. Y., is erecting an addition to its plant, which will more than double its capacity. The concern manufactures electric trucks.

Julian L. Franck, secretary and purchasing agent of the Institutions Purchasing Co., 253 Broadway, New York, N. Y., will buy for an industrial school at Pleasantville, N. Y., machinery and equipment as follows:

Two engine lathes,
Milling machine,
Planer,
Shaper,
Power hack saw,
Drill press, for heavy drilling,
Sensitive drill,
Emery grinder,
Speed lathe.

These tools will be driven by individual motors.

For the electrical shop several small motors will be purchased.

Bids will be received by the Board of Education of Jersey City, N. J., George E. Tennant, chairman; John T. Rowland, Jr., architect, 13 Exchange Place, for machine-tool equipment for the new technical and industrial high school. The general conditions provide that bidders will be allowed to bid on one or more items of the specifications. The equipment includes the following:

One high-speed driller with 12-in. overhang, 26x28-in. table, similar to the Henry & Wright Manufacturing Co. 15-in. motor driven high-speed driller.

One radial driller, vertical range, 27 in.; horizontal range, 27 in., equal to 36-in. Cincinnati-Bickford plain driller.

Two 21-in. upright drillers.

Four motor driven sensitive drills having a capacity to drill to a center of 12-in. diameter.

One No. 1 universal grinding machine, swing, 10 in.; length, 24 in.; similar to Brown & Sharpe No. 1 universal grinding machine.

Two universal cutter and reamer grinders, No. 3, having a capacity to take up to 18 in. between centers by 6 in. in diameter, similar to No. 3 universal grinding reamer machines, Brown & Sharpe.

One cylindrical grinding machine, which will swing work 6 in. in diameter and up to 32 in. in length, similar to the Norton 6x32-in. cylindrical grinding machine, electrical drive.

Two universal cutter and tool grinders, having a capacity to take work 12 in. in diameter by 36 in. in length, similar to No. 2 Cincinnati universal cutter and tool grinders.

Two wet-tool grinders with grinding wheel 20x2½ in., similar to the improved new motor-driven wet-tool grinders manufactured by J. G. Blount Co.

Forty engine lathes having a swing of 14½ in., a maximum distance between centers of 26 in., similar to Prentice Bros. 14-in. lathe, F. E. Reed Co. 14-in. lathe and Hendey Manufacturing Co. 14-in. lathe.

Four power hack saws, motor driven, having a capacity up to 6 in. and a stroke of 6 in.; blades, 10 to 14 in. Equal to No. 2 Hoefer motor-driven power machine.

Four arbor presses, equal to No. 4 Greenard arbor press.

A complete hardening and tempering plant.

Eleven double down-draft forges, each with a fire pan of 30 sq.in.

One automatic band-saw setter and filer having a capacity of filing blades ⅜ to 1½ in. wide.

Two motor-driven geared-head lathes, 16 in.x16 ft.

Ten bench lathes.

One turret lathe, 1x15 in.

One 30-in. boring and turning mill.

One 10-in. tool maker's lathe.

Four No. 1½ universal milling machines.

One horizontal boring, drilling and milling machine.

One planer, 22 in.x6 ft.

One planer, 28x28 in.x8 ft.

Four 14-in. shapers.

Two 16-in. shapers.

The specifications also call for a number of drills, hammers and clamps for use in schools and machine shops.

The plant of the Haves Boiler Manufacturing Co., Paterson, N. J., was destroyed by fire on Feb. 20. The loss is $60,000.

The United States Cartridge Co., Perth Amboy, N. J., is planning the erection of additions to its plant. A new factory will be constructed and modern machinery installed.

It is reported that plans are being prepared by the Pennsylvania R.R. for the erection of large repair shops at Sunbury, Penn. The shops will include machine, boiler, blacksmith and car-repair departments. The estimated cost is $200,000. A. W. Gibbs, Philadelphia, Penn., is chief mechanical engineer.

The plants of the Diamond Forging & Manufacturing Co. and the Pittsburg Steel Manufacturing Co., Chartiers St. and Ridge Ave., Pittsburg, Penn., were damaged by fire, Feb. 22. Loss, $100,000.

The three-story brick machine shop of the Germantown Tool Works, Germantown, Penn., was destroyed by fire, Feb. 27, causing a loss estimated at $75,000.

The Duff Manufacturing Co., 405 Marion Ave., Pittsburg, Penn., has purchased ground at Chartiers and Hoffman Sts., and will erect a plant. The company manufactures the Barrett lifting jack.

SOUTHERN STATES

The American Motor Car Co., Charlotte, N. C., will erect a garage to cost $25,000. George F. Rutzler is secretary and manager.

The Palmetto Iron Works, Greenville, N. C., will erect a brick foundry, 40x117 ft.

C. A. Devine, Bishopville, S. C., expects to build a plant for the manufacture of metal signs.

The contract for the construction of a new rolling mill and for new reheating furnaces has been awarded by the Atlanta Steel Co., Atlanta, Ga., to the Morgan Construction Co., Worcester, Mass. The cost of the improvements is $150,000.

The Florida Metal Products Co., Jacksonville, Fla., will erect a plant, at Evergreen Ave., and the St. Johns River Terminal Co., several buildings will be built.

The Chattanooga Roofing & Foundry Co., Chattanooga, Tenn., will shortly be in the market for special machinery.

The Nashville, Chattanooga & St. Louis Ry. will construct yards at Berclaire, a suburb of Memphis, Tenn. A roundhouse and machine shop will be built.

The Newport Rolling Mill Co., Newport, Ky., has awarded a contract to the McClintock-Marshall Construction Co. Pittsburg, Penn., for the erection of a boiler house, and an extension 200x250 ft. to the main mill.

Bids will be received until Mar. 11, in the office of Mayor N. C. Ridgway, at Falmouth, Ky., for electric-light equipment consisting of engines, generators, etc. Specifications may be obtained of Anderson & Frankel, engineers, Lexington, Ky.

MIDDLE WEST

The Gas Fixture & Brass Co., Cleveland, Ohio, has purchased the entire plant of the United Brass Manufacturing Co. New machinery for the making of gas fixtures and plumbers' brass supplies will be purchased.

C. O. Bartlett & Snow Co., Cleveland, Ohio, makers of conveying and mine machinery, has raised its capital to $500,000, and will buy new machine-shop equipment.

The Blauser Lumber Co., Marion, Ohio, will buy new wood-working tools.

The F. B. Stearns Auto Co., Cleveland, Ohio, makers of the Stearns automobile, will make large additions to its plant.

The Allyne Brass Foundry, Cleveland, Ohio, will make large additions to its plant and buy power and foundry equipment.

The Cleveland Metal Products Co., Cleveland, Ohio, has increased its capital from $200,000 to $1,000,000. An addition is being planned for its plant, on Ivanhoe Road.

The Meilink Manufacturing Co., of Toledo, Ohio, safe manufacturers, will erect a new factory, at a cost of $100,000. Chester D. Clapp is president.

The Otis Steel Co., Cleveland, Ohio, is planning to erect a large new steel plant to make steel castings and plates.

The Dayton Steel Construction Co., 1249 West Third St., Dayton, Ohio, has awarded the contract for the construction of a one-story factory, 80x211 ft., and a one-story power plant, 46x90 ft. The cost is $22,000.

The Troy Foundry Co., Troy, Ohio, will rebuild its recently burned foundry.

The plant of the Canton Brass & Machine Co., Canton, Ohio, was damaged by fire, Feb. 22. Loss, $3000.

The Westlake Machine Co., Toledo, Ohio, has increased its capital stock to $1,500,000, and will enlarge its plant.

The Grant-Lees Machine Co., Quincy St., East Cleveland, Ohio, has let the contract for a large machine shop, to cost $25,000.

Contracts have been let for the erection of a two-story machine shop and office building by the B. B. Manufacturing Co., Cleveland, Ohio. The firm does general machine and automobile-repair work and also manufactures auto parts.

The American Stove Co., Cleveland, Ohio, has awarded the contract for a factory building. It will be mostly equipped with polishing machines.

City Engineer Ballard reported to Mayor Baker, of Cleveland, Ohio, that he has completed the specifications of the electrical machinery to be installed in the electric-light plant, now under construction. Contracts will soon be let.

The Oakwood Street Ry. Co., Dayton, Ohio, will build a new power plant and shop to replace the one recently burned. New equipment will be installed in the shop for the building of its own cars.

The Struthers Wells Co., Warren, Ohio, will construct an addition to its boiler plant, costing $75,000.

The foundry of the Schwab Safe & Lock Works, at Lafayette, Ind., was destroyed by fire, on Feb. 21.

The American Agricultural Chemical Co., George B. Burton, manager, Foreman and Carbon Aves., Detroit, Mich., is having plans prepared for a one-story power house, 56x151 ft. The owners will purchase materials. The cost is $35,000.

The Industrial Works, makers of contractors' equipment, Charles R. Wells, secretary, 135 Washington St., Bay City, Mich., contemplates erecting a machine shop, 150x525 ft., a storage building, 60x300 ft., and a car shop, 150x300 ft. All buildings will be located at Water, Garfield and Columbus Sts. The estimated cost is $1,000,000.

The Breed Motor Manufacturing Co., of Detroit, Mich., will remove its plant to Bay City, and will erect a two-story factory, 50x150 ft., early in the spring. Address O. J. Morton, 523 Harrison Ave., Bay City, Mich. The estimated cost is $40,000.

The Modern Pattern Shop, 12 Sherman St., Detroit, Mich., announces that it has secured a factory at Rivard and Sherman Sts., and will equip it with new machinery.

Fire partly destroyed the Broadway Auto Garage, 36-40 John R St., Detroit, Mich., Feb. 23. Twenty touring cars were either destroyed or badly damaged. Loss, $25,000. Charles Berdan is owner.

WEST OF THE MISSISSIPPI

The contract for the construction of a new factory building for the Hunt & Schuetz Hardware Co., at West Third and Kansas Sts., Sioux City, Iowa, has been awarded. The building will be three stories high, 120x136 ft., of mill construction and cost $20,000.

The A. Y. McDonald Manufacturing Co., manufacturers of pumps, Dubuque, Iowa, is considering the erection of an addition to its plant. It will be four stories high, 260x100 ft., and cost about $75,000.

A roundhouse at Logan, Mont., owned by the Northern Pacific Ry. Co., was destroyed by fire, Feb. 24.

Fire damaged the two- and three-story brick building, No. 612 South Sixth St., St. Louis, Mo., owned by the Allsop Process Co., manufacturer of mill machinery, Feb. 28. Loss, $4000. Insurance, $6750.

Brewer & Gore, Memphis, Tenn., have purchased an electric-light plant and water-works, at Imiboden, Ark. A new boiler and other machinery will be installed.

The Chicago, Rock Island & Pacific Ry. will improve its shops and roundhouse, at Biddle, near Little Rock, Ark. The estimated cost is $60,000.

The Little Giant Stove & Novelty Co., Fort Worth, Tex., will establish a plant to manufacture gas stoves. J. H. Greer is president.

The West Shannon Manufacturing Co. will erect a factory in Pueblo, Colo., for the manufacture of a patent door lock. L. Morgan West is secretary.

CANADA

The C. O. Clark Brass Co., of Montreal, Ont., will equip a new brass foundry.

The London Street Ry. Co. will install a new steam plant and electric apparatus. C. B. King is manager.

The Canadian Quilton Co. will locate a large new factory, at Montreal. H. Weinfield is manager.

Acton, Ont., will equip a new hydro-electric substation.

Stratford, Ont., will equip a municipal machine shop.

Winnipeg, Man., is calling for tenders up to Mar. 25 for complete new fire and police telegraph systems.

The Walkerton Electric Light Co., Walkerton, Ont., will purchase new equipment, turbine, generator, etc.

The Canadian Boomer & Boschert Press Co. will build a big new factory, at Montreal, Que. Manufacture hydraulic presses.

The Coquitlam Star Publishing Co. will locate a new plant, at Coquitlam, B. C.

The Maritime Nail Co., of St. John, N. B., will extend its plant.

The Standard Iron Co. will locate a new plant at Montreal, Que. R. J. Mercur is manager.

The Cornwall Foundry Co., of Cornwall, Ont., will extend its plant.

The Canadian Maw Brakes Co. will locate a big plant in Montreal, Que., for manufacturing brakes.

The Canadian Pacific Ry. will install new pumping stations at Field, B. C., Revelstoke and Kamloops, rock crushing and gravel washing plants, and will make other improvements costing $5,000,000.

The Sherbrooke Iron Works Co. will locate a new factory at Sherbrooke, Que.

The General Fire Extinguisher Co. will equip a big new plant in Toronto, Ont.

Fire caused a damage of $12,000 in the plant of F. Thompson & Co., manufacturers of electric motors, 326 West Craig St., Montreal, Que. Insurance, $5000.

The Canadian General Electric Co., Toronto, Ont., has received a permit for the erection of a building for light manufacturing purposes, on Dufferin St. It will be three stories high and cost $87,000.

General Manufacturing

NEW ENGLAND STATES

A shoe factory will be built by Lunn & Sweet, as an addition to the present factory, at Auburn, Maine. It will be 50x170 ft., four stories high, with an ell, 40x50 ft.

Owing to increasing business the Silesia Worsted Mills, Ltd., North Chelmsford, Mass., is considering building an addition, 210x69 ft., four stories high.

The state of Massachusetts contemplates the installation of an electric-lighting plant at the county jail, Worcester, Mass. The county commissioners have charge.

The general contract for the erection of a textile mill, 124x456 ft., four stories high, a new stockhouse, 100x180 ft., seven stories high, and a factory addition, 122x400 ft., for the West Boylston Co., on Pleasant St., Easthampton, Mass., has been awarded to Casper Ranger, Holyoke. All will be built of brick and mill construction.

The Stetson Shoe Co. will build an addition to its factory at South Weymouth, Mass. It will be of brick and wood construction, 100x50 ft., three stories high.

The three-story wooden factory on Central St., Leominster, Mass., occupied in part by the Puritan Comb Co., was damaged by fire, Feb. 24. Loss, $3000.

Fire broke out in the sawdust chute of the Otis Allen box shop, Farnham and Mt. Vernon Sts., Lowell, Mass., Feb. 20, and caused a loss of $8000.

Howarth & Sons, flannel manufacturers, Oxford, Mass., whose mill was burned on Jan. 11, with a loss of $60,000, have started work on the foundation for a new mil. It will be of brick, 143x54 ft., and four stories high.

The No Dust Drying Machine Co., 40 Clifford St., Providence, R. I., is contemplating the enlargement of its plant and will install new machinery.

A contract has been awarded for the additions to the factory of the Glastonbury Knitting Co., at Addison, Conn. One addition will be 40x45 ft., two stories high; another 32x57 ft., one story high, both of brick.

The contract has been given to M. A. Durrschmidt for building the addition to the factory of the Star Pin Co., at Shelton, Conn., the plans for which are by architect L. W. Robinson, of New Haven. It will be 24x111 ft., two stories, of brick, heavy mill construction and gravel roof.

Plans have been prepared by S. M. Green, Inc., Springfield, Mass., for an addition to the plant of A. & E. Henckels, manufacturers of lace, on Connecticut Ave., Bridgeport, Conn. It will be of brick and sandstone, 66x188 ft., two and one-half stories high. The cost will be about $50,000.

The three-story brick factory building on Cannon St., Bridgeport, Conn., of the Boone Folding Paper Box Co., was damaged by fire. The upper stories will be repaired and a new roof put on.

The L. F. Dettenborn Woodworking Co., Hartford, Conn., has awarded the contract for a wood-working mill, 57x152 ft., two stories and basement, and a boiler house and kiln dry room, 36x42 ft., one story.

The general contract for the new factory, at Main and Pearl Sts., Bristol, Conn., for the American Silver Co., has been awarded to the B. H. Hibbard Co., New Britain, Conn. It will be of brick, 50x36 ft., two stories high.

The contract for the additions to the plant of the C. G. Garragus Manufacturing Co., Bristol, Conn., has been awarded to C. J. Waldo. The buildings will be 40x25 ft., three stories high. Sperry & Buell, of New Haven and Bristol, are the engineers.

Plans for a brick addition, 36x129 ft., two stories high, to the Empire Steam Laundry, on Sheldon St., Hartford, Conn., are being prepared by E. M. Stone, architect. The building will be of reinforced concrete.

MIDDLE ATLANTIC STATES

The Greenway Brewing Co., Syracuse, N. Y., has plans for putting up a new addition, with equipment, this spring.

The Cataract Rubber Co., 320 White Building, Buffalo, N. Y., is considering the construction of a three-story, reinforced-concrete factory. H. L. Brickall, 384 Breckenridge St., is the architect.

Plans have been completed for the new plant of the Buffalo Corrugated Paper Box Co., at Imson St. and the Lehigh Valley R.R., Buffalo, N. Y. It will be 119x119 ft., two stories high, of brick and steel.

The F. F. Dalley Co., manufacturer of shoe polishes, will build a brick and concrete addition, 70x200 ft., three stories and basement, to its plant at Military Road and the Erie R.R., Buffalo, N. Y., to cost $45,000.

The Webster Canning & Preserving Co., Webster, N. Y., has plans completed for a two-story and basement canning factory and cold-storage warehouse, of concrete and steel construction, 105x105 ft.

The Myers Manufacturing Co., ladies' garments, has established a branch factory at Poughkeepsie, N. Y., and is said to contemplate erecting a factory building.

The Saratoga Graphite Co. plans the construction of a mill at Troy, N. Y. Machinery estimated to cost $17,000 will be installed.

Goodwillie & Son are having plans prepared for their new canning factory to be erected in Welland, N. Y.

The Niagara Falls Linen Co., Niagara Falls, N. Y., has just been incorporated with a capital of $120,000. It will erect and equip a plant to cost approximately $75,000, and will make towels, napkins and similar articles.

The Eagle Button Co., Newark, N. J., has rented a building for a factory at Seneca Falls, N. Y.

The Seydel Manufacturing Co., 81 Steuben St., Jersey City, N. J., is having plans prepared by Joseph C. Schaeffler & Co., engineers, 38 West Thirty-second St., New York, N. Y., for the construction of a two-story factory and a one-story boiler house. The estimated cost is $25,000.

Fire damaged the three-story brick factory building on Nassau St., between Sheffield and Boyden Sts., Newark, N. J., Feb. 26. The building was occupied by the Myler Wax Paper Manufacturing Co., the Consolidated Button Co., the Essex Ivory Button Co., the Fireproof Paint Co. and Kirschman Bros., makers of manicurists' implements. Loss, $30,000.

Fire and water damaged the plant of the Patton Paint Co., Chester and Riverside Aves., Newark, N. J., Feb. 24. Loss, $4000. George D. White is superintendent.

The wooden annex to the shoe factory of Charles Keighley & Sons, Vineland, N. J., was destroyed by fire, Feb. 24. The building contained a button department, a shoe store, a machine repair shop and a storage for surplus stock. Loss, $60,000; insurance, $50,000.

John H. Brooks is placing orders for equipment for a brick plant to be built at Beaver Falls, Penn.

The W. G. Wilkins Co., Westinghouse Building, Pittsburg, Penn., is completing plans for a four-story concrete factory addition for the Standard Underground Cable Co., at Pike and Sixteenth Sts. The lot measures 46x110 ft.

The Davenport Mills, Waterloo and York Sts., Philadelphia, Penn., were damaged by fire, Feb. 24. Loss, $5000. Two upper floors of four-story structure were occupied by Andrew Alexander & Sons, manufacturers of carpet yarns; the lower floors by F. G. Lentz Card Stamping Co.

Fire, at Franklin and Vine Sts., Philadelphia, Penn., caused a loss of nearly $1,000,000, and destroyed the plants of the Hensel-Colladay Co., manufacturer of millinery and dress trimmings, H. P. Feld, manufacturer of shirt waists, and the Economical Shirt Manufacturing Co.

The Thatcher Manufacturing Co., manufacturer of milk bottles and bottle caps, will construct a new plant at Kane, Penn.

The plant of the Delmar Milling Co., Delmar, Del., owned by S. J. Hitchens and Joseph Wells, was destroyed by fire, Feb. 24. Loss, $10,000; insurance, $6500.

The Gottlieb - Bauernschmidt - Strauss Brewing Co., Hanover and Conway Sts., Baltimore, Md., has awarded a contract to Fred Decker & Son, 1209 East Biddle St., for the construction of a one-story bottling plant at Oliver and Chestnut Sts. It will be 44x100 ft., of brick, and cost $10,000.

A contract has been awarded to John L. Moylan to construct a factory at 1822-1824 Lancaster St., Baltimore, Md., for the Union Box Co. The structure will be three stories high, 32x58 ft., and is estimated to cost $5000.

Fire destroyed the Arlington Flour Mills, owned by Cissell Bros., Washington, D. C., Feb. 20. Loss, $150,000.

SOUTHERN STATES

Binswanger & Co., Richmond, Va., will rebuild its sash and door plant recently destroyed by fire, at a loss of $175,000.

The Northumberland-Potomac Packing Corporation, Sunnybank, Va., has organized and will erect a packing plant. R. L. Williams, Rudville, Va., is president.

The Huntington Clay Products Co., Huntington, W. Va., has purchased 228 acres of land in Wayne County upon which it is proposed to erect a brick plant. The company will also build four miles of trackage to connect with the Norfolk & Western R.R.

The Grandin Lumber Co. will erect two band mills and a planing mill at Lenoir, N. C.

W. A. Gibson, Bryson City, N. C., is interested in the construction of a pulp mill there.

Fire completely destroyed the ginnery of the Timmonsville oil mill, Timmonsville, S. C., entailing a loss of $15,000. The plant was fully covered by insurance.

H. A. Cook, Charlotte, N. C., and T. L. Johnson, Rock Hill, S. C., will construct a cotton bagging factory at Brunswick, Ga.

The Home Guano Co., Dothan, Ala., has awarded a contract to the J. M. Morgan Co., Birmingham, for the construction of a factory for the manufacture of fertilizer. The cost is $125,000.

J. H. Gastona has awarded a contract to H. F. Huestis, Pass Christian, Miss., for the erection of a turpentine plant at Hattiesburg, Miss. The plant will include a boiler house, 36x60 ft.; a three-story main building, 49x85 ft., a tank house and office building.

The Swayze Packing Co., Monroe, La., will rebuild its packing plant, recently destroyed by fire, at a loss of $60,000.

The Arctic Ice & Coal Corporation, James Building, Chattanooga, Tenn., is receiving bids for the construction of a 100-ton ice plant. B. Brown, James Building, is in charge.

McClaine & Armstrong, manufacturers of marble and granite monuments, are considering plans for the erection of a plant, at Hopkinsville, Ky. It will consist of a show room, 60x20 ft.; a shop, 20x22 ft.; a stock barn, 40x60 ft., and a cutting factory, 60x200 ft.

CENTRAL STATES

Power and electrical equipment will be purchased for a 15-story hotel to be built at Cleveland, Ohio, by J. H. Fuller, of Warren.

The Portage Rubber Co., Akron, Ohio, will soon draw plans for an addition to its factory at Barberton.

The Daisel Wemmer Co., Lima, is having plans prepared by McLaughlin & Hulskin, Centrad Building, Lima, for the construction of a four-story, 50x114 ft., cigar factory, at Findlay, Ohio.

Jacob Schlachter & Sons, butchers, 2844 Colerain Ave., Cincinnati, Ohio, are receiving bids for the enlargement of their plant. A slaughtering house and ice plant, two stories high, 45x75 ft., will be built.

The plant of the Lindow, Leibus & Gerchow Co., 220-222 Superior St., Toledo, Ohio, manufacturer of furniture and decorations, was destroyed by fire, Feb. 16. Loss, $60,000; insurance, $35,000.

Bids are being received for a new plant for the Springfield Tire & Rubber Co., at Springfield, Ohio. The building will be two stories high, 50x200 ft., of brick and steel construction.

G. Shirley and E. H. Gordon, Elkhart, Ind., will construct a factory on South Front St., Fremont, Ohio, for the manufacture of paper boxes.

The Wabash Pottery Co., Roseville, Ohio, announces that the present plant, located in the central part of the town, will be abandoned and a new plant erected near the town limits.

The H. & H. Manufacturing Co., Akron, Ohio, incorporated by J. Hadfield and G. P. Homeier, will equip a plant to make rubber novelties.

The McGraw Tire & Rubber Co., East Palestine, Ohio, is considering the enlargement of its plant. New machinery will be purchased.

The Indiana Canning Co., Evansville, Ind., is preparing to ask bids for the erection of a new factory.

John Beatty has ordered plans on which he will ask bids, for the erection of a factory at Columbus, Ind., for the Reliance Manufacturing Co., of New York and Chicago.

The Studebaker Manufacturing Co., South Bend, Ind., will receive bids as soon as plans can be completed for the construction of a dry kiln. Work will begin in the spring.

The Holland & St. Louis Beet Sugar Co. is building a plant at Decatur, Ind.

The Roach-Brown Manufacturing Co., Cumberland, Ind., will ask bids as soon as plans are completed for the construction of a factory on the site of the building recently destroyed by fire. A. G. Brown is secretary.

The plant of the Grand Rapids Veneer Works, Grand Rapids, Mich., was damaged by fire, Feb. 21. Loss, $10,000.

The Creamery Package Manufacturing Co., 61 West Kinzie St., Chicago, Ill., is receiving bids for the construction of a new factory. It will be six stories high, 80x92 ft., and cost $75,000. Carl Nielson, 154 West Randolph St., is the architect.

The El Paso Canning Co., El Paso, Ill., is having plans prepared by McMeans & Tripp, Majestic Building, Indianapolis, Ind., for the construction of factory buildings, including warehouse, canning factory and power house, costing $50,000.

Avery & Co. are having plans prepared by Carl Koechlin, architect, for the construction of a new factory at Peoria, Ill. It will be one story high, 152x180 ft., and cost $25,000.

The candy factory of Giacomo Allegretti, East South Water St., Chicago, Ill., was destroyed by fire, Feb. 27. Loss, $15,000. Insurance, $17,000.

The Bissell Laundry, 649-651 East Thirty-ninth St., Chicago, Ill., was destroyed by fire, Feb. 23. Loss, $15,000. G. H. Starr is president.

Fire gutted the plant of the Knickerbocker Briquet Co., Muryphysboro, Ill., Feb. 18. The plant was valued at $100,000.

The dry-starch factory of the Corn Products Co., Waukegan, Ill., was destroyed by an explosion, Feb. 20. Loss, $4000.

The Burson Knitting Co. will construct a four-story concrete addition to its plant on South Mill St., Rockford, Ill. Estimated cost, $30,000.

The Milwaukee Yacht & Boat Co., Milwaukee, Wis., has been incorporated with a capital of $20,000, to take over the plant and business of the Eastern Boat Building Co. The new firm will enlarge the plant and make extensive improvements. Equipment will be purchased for the manufacture of launches, cruisers, etc.

Plans have been completed by the Milwaukee School of Aviation for the erection of a building at the foot of Sixty-fourth St., Milwaukee, to be used as a factory for the manufacture of aëroplanes. The structure will be one story high, 50x200 ft., of concrete and steel construction.

The George J. Meyer Manufacturing Co., 584 Clinton St., Milwaukee, is considering the proposition of erecting a new plant on a different site during the present year.

H. C. Hengels, architect, 702 Grand Ave., Milwaukee, Wis., is taking bids for the erection of a $35,000 plant for the American Malted Food Co., at Waukesha, Wis. The main building will be of brick construction, 60x105 ft. and the power and lighting plant, 34x46 ft.

Plans have been completed for the erection of a brick factory for E. R. Steinman, 496 Fortieth St., Milwaukee, Wis., at St. Paul Ave. and Twenty-fifth St. It will be one story high, 80x200 ft.

WEST OF THE MISSISSIPPI

The A. Y. McDonald Manufacturing Co., Dubuque, Iowa, will construct an addition to its plant at Thirteenth and Maple Sts. The building will be 100x260 ft. and is estimated to cost $75,000.

The contract for the erection of a creamery for the David Cole Creamery Co., Tenth and Howard Sts., Omaha, Neb., has been awarded to McGowan & Jacobberger, 410 Jackson St. It will be two stories high, 132x132 ft., of brick construction, and will be erected at Fourteenth and Jones Sts.

The Winter Langeneckert Folding Box Co., 715 South Sixth St., St. Louis, Mo., has filed plans for the construction of a factory at Rutger St. and Mississippi Ave. It will be two stories high, of brick and reinforced concrete.

The factory and warehouse of the Rosenthal-Sloan Millinery Co., 921-29 North Eleventh St., St. Louis, Mo., were damaged by fire, Feb. 22. Loss, $1100.

The plant of the Emil Metzenaur Baking Powder Co., 211 South Third St., St. Louis, Mo., was damaged by fire, Feb. 24. Loss, $5000; covered by insurance.

The St. Joseph Paper Box Co. will occupy a two-story factory on Francis St., St. Joseph, Mo. The building will be remodeled and enlarged at a cost of $10,000. S. H. Goodyear is principal stockholder.

C. D. Lovelace, San Angelo, Tex., is at the head of a company with $50,000 capital, which will erect a plant for the manufacture of trap guns.

The San Benito Gin Co., which has been formed at San Benito, Tex., will erect a cotton gin. The equipment will consist of a 350-hp. water-tube boiler, and will have a capacity of 20 bales per hour.

W. R. DuPuy will enlarge his overall factory at Quanah, Tex., and install additional machinery.

The Del Rio Electric Light & Ice Co., Del Rio, Tex., is installing a 30-ton ice plant here.

Geo. F. Hoedtke is installing a creamery at Bowie, Tex.

H. B. Pitts, Marshall, Tex., will erect a flour mill and grain elevator at Longview.

The Tiffin Crushed Stone Co. will install new machinery in its crushed-stone plant at Ranger, Tex.

Tommie Bros. will erect a sawmill at Gist, Tex. The plant will have a capacity of 30,000 ft. of lumber per day.

I. E. Franklin, Bay City, Tex., will establish an ice-cream factory.

The Hillsboro planing mills, Hillsboro, Tex., were destroyed by fire, Feb. 20. Loss, $6000; insurance, $2300.

Fire destroyed the cotton gin of the Austin Oil Manufacturing Co., at Manor, Tex., Feb. 19. Loss, $6000; insured.

A brick plant, owned by C. A. Benton, Corsicana, Tex., was destroyed by fire, Feb. 17. Insurance, $27,250.

The Texas Bag & Fiber Co. is preparing to construct a $500,000 plant in North Fort Worth, Tex.

The Great Western Oil Co., Denver, Colo., has received a permit to construct a new oil plant, on Argo St., north of Twenty-third St. Elmer E. Sommers is manager.

WESTERN STATES

G. A. Carley, Modesto, Calif., is contemplating starting a plant at Modesto for the manufacture of farm machinery, implements, etc. The company expects to expend the sum of $20,000 in equipping the plant.

The San Diego Vitrified Brick & Clay Products Co., San Diego, Calif., will erect a plant on the Santa Fé tracks at Division St. for the manufacture of brick and tile sewer pipe, etc. C. E. Anthony, 858 Fourth St., is one of the organizers of the company.

The Brookings Lumber & Box Co. will add a lumber yard to its plant and erect sheds and offices and a planing mill at Bloomington, Calif.

The United Water & Power Co., Gold Run, Calif., recently incorporated, is planning the construction of several power plants. James D. Stewart, Gold Run, is president.

The Diamond Laundry Co., 241 East Fifth St., Los Angeles, Calif., has purchased a site at Fowne Ave. and Eighth St. and will construct a laundry building. It will be 110x200 ft., of reinforced concrete, and cost about $150,000.

The Pacific Carbon Co., Oakland, Calif., will erect a factory in East Oakland, on a four-acre tract, south of Lloyd Ave. and west of Laundry Farm Road, at a cost of $10,000.

Four new grain elevators are to be erected at the plant of the Globe Grain & Milling Co., San Pedro, Calif., during the spring.

CANADA

The Ottawa Electric Ry. Co., Ottawa, Que., will erect an auxiliary steam plant. A $600,000 stock issue has been made to provide for the improvement.

The Canadian Ammonia Co. will equip a factory in Toronto with the latest machinery.

The Consolidated Pulp & Timber Co., Lancaster, N. B., will buy new machinery. Hon. Robert McKay, Montreal, president.

The Standard Job Printing Co. will equip a new plant at St. John, N. B. H. V. McKinnon is manager.

The Russell Shale Brick Co. will equip a plant at Russell, Ont. G. F. Hodgins, Shawville, Que., is manager.

The Manning Cold Storage Co. will equip a plant at Toronto, Ont.

The Winnipeg Ceiling & Roofing Co., Winnipeg, Man., will double its factory.

The Progressive Printing Co. will equip a new plant at Morinville, Alta.

The Thomas Manufacturing Co., St. Thomas, Ont., will locate a branch factory at Outrement, Que. Wood-working machinery required.

The J. H. R. Molson Bros. Brewery Co will extend its plant at Montreal, Que.

The Alabastine Hardmortar Co. will equip a new $25,000 plant at Scarborough, Ont. T. J. Smyth is manager.

The White Island Sulphur Co., Vancouver, B. C., will buy equipment for developing extensive properties.

The British-Canadian Co., Ltd., will construct a canning factory at Highgate, Ont. Estimated cost, $45,000.

The J. H. Wethey Co., Ltd., will construct a factory at St. Catharines, Ont., for the manufacture of mince meat

FOREIGN

The Sonora Trading Co. will erect a 75-bbl. flour mill at Agua Prieta, Sonora, Mexico.

C. A. Smith, Pasadena, Calif., and Robert A. Graham, Esperanza, Mex., are planning the construction of a packing house and cold-storage plant, at Guaymas, Mexico. About $50,000 is available for this purpose.

New Incorporations

METAL WORKING

The Marble Machinery Co., Dorset, Vt., has been incorporated, with a capital of $5000 to manufacture machinery. The incorporators are Myson A. Brophy, East Dorset; Edward Griffith, Manchester; Walter R. Hard, Manchester, and G. L. Tawley, Manchester.

The Automatic Stucco Mach. Co., Portchester, N. Y., has been incorporated, with a capital of $50,000, to manufacture stucco machines, cement, cement products, etc. The incorporators are W. A. Mills, Portchester; R. H. Cunningham, Stamford, Conn., and E. B. Southworth, New York.

The Consolidated Fireproof Materials Co., New York, N. Y., has been incorporated, with a capital of $100,000, to manufacture fireproof building materials. The incorporators are R. E. Barrett, H. R. Nostrand and E. L. Shea, Brooklyn.

The Cash Register Co., New York, N. Y., has been incorporated, with a capital of $10,000, to manufacture cash registers. The incorporators are Raphael Freedman, 16 West One Hundred and Seventeenth St.; Edward Sher, 1344 Park Ave., and John G. Keeler, 7 East One Hundred and Twenty-ninth St., New York.

The Economic Twist Drill Co., New York, N. Y., has been incorporated, with a capital of $200,000, to manufacture machinery, dies and tools. The incorporators are William H. Todd, Clarendon Hotel; John M. Zurn, 432 Eighth St., and John J. O'Brien, 837 Herkimer St., Brooklyn, N. Y.

The Enterprise Metal Bedstead Co., New York, N. Y., has been incorporated, with a capital of $20,000, to manufacture metal bedsteads. The incorporators are B. Schwartz, 104 Columbia St., and Harry Bazzar, 280 Stanton St., Brooklyn, N. Y., and Max Feldesk, 11 West One Hundred and Seventeenth St., New York.

The E. M. Karmel & Siedman Co., Brooklyn, N. Y., has been incorporated, with a capital of $10,000, to manufacture silverware. The incorporators are E. M. Karmel, 258 Wythe Ave., Brooklyn; U. Siedman, 2092 Madison Ave., and A. Karmel, 165 Broadway, New York, N. Y.

The Motor Installation Co., New York, N. Y., has been incorporated, with a capital of $30,000, to manufacture machinery. The incorporators are L. E. Judson, 771 East Thirty-second St.; N. M. Brown and R. J. Kent, 215 Montague St., Brooklyn.

The Brockport Hardware Co., Brockport, N. Y., has been incorporated, with a capital of $10,000, to manufacture hardware. The incorporators are W. D. Wells, Spencerport; B. W. Brown, Spencerport, and T. H. Patterson, Brockport, N. Y.

The Speedwell Motor Truck Co., New York, N. Y., has been incorporated, with a capital of $50,000, to manufacture automobile trucks. The incorporators are G. A. Rendreigh, Queens Road, Queens, L. I., N. Y.; J. Friedman, 12 Myrtle Ave., Brooklyn, N. Y., and J. B. Unlacke, 683 E. Two Hundred and Thirty-sixth St., New York.

The Visigraph Typewriter Co., New York, N. Y., has been incorporated, with a capital of $60,000, to manufacture typewriters. The incorporators are H. F. Dreitwieser, 48 East Sixty-ninth St.; W. P. Dreitwieser, 77 East Eighty-ninth St., and W. J. Spiro, 10 West One Hundred and Twenty-first St., New York.

The Bissell Garage Co., Syracuse, N. Y., has been incorporated, with a capital of $10,000, to operate a garage. The incorporators are W. H. Bissell, 109 S. State St., and B. Watte, 120 Cannon St., Syracuse, N. Y.

The Acorn Tire & Supply Co., Newark, N. J., has been incorporated, with a capital of $50,000, to manufacture automobile supplies. The incorporators are H. L. Carroll, P. C. Nissley and M. I. Anson, Newark.

The Cliffside Motor & Supply Co., Cliffside Park, N. J., has been incorporated, with a capital of $50,000, to do a general automobile business. The incorporators are A. E. Neumann, A. C. Neumann, J. H. Neumann, Grantwood, and G. F. Walker, Cliffside Park.

The Knight Manufacturing Co., Lancaster, Penn., has been incorporated with a capital of $10,000, to manufacture structural iron and steel, hardware, tools, forgings and castings. The incorporators are M. J. Knight, Paul Reincke and Amos R. Gohndy.

The Lee & Parr Hardware Co., Clarksburg, W. Va., has been incorporated, with a capital of $19,000, to manufacture hardware. The incorporators are C. W. Lee, W. G. Parr, B. Parr and F. O. Sutton.

The Leach Norman Hardware Co., Star, N. C., has been incorporated, with a capital of $20,000, to manufacture hardware. The incorporators are E. Leach, J. Leach, Star, and J. C. Norman, Statesdale, N. C.

The Conover-Overkamp Co., Dayton, Ohio, has been incorporated, with a capital of $65,000, to operate a machine shop and general foundry. The incorporators are P. H. Conover, C. H. Conover, C. H. Overkamp, E. G. Denlinger, R. B. Finks and P. N. Sigler.

The Brockett-Gorham Co., Marion, Ohio, has been incorporated, with a capital of $25,000, to manufacture and sell engines, boilers and a general line of machinery. The incorporators are Don E. J. Brockett, S. K. Gorham, Maud S. Gorham, Florence J. Brockett and George D. Copeland.

The Vulcan Iron Works, Toledo, Ohio, has been incorporated, with a capital of $10,000, to carry on a general foundry and machinery business. The incorporators are Fred H. Kirtley, Sigmond Sanger, Vada C. Southard, Trude Wooster and Aaron B. Cohn.

The N. S. W. Motor Co., Indianapolis, Ind., has been incorporated with a capital of $60,000 to manufacture motors. The incorporators are C. Nelson, L. Sagalowsky and F. W. Wellman.

The McClernan Metal Products Co., Chicago, Ill., has been incorporated, with a capital of $50,000, to manufacture metal goods. The incorporators are Louis F. McClernan, James McClernan and William Sherman Carson.

The Illinois Gasoline & Kerosene Engine Co., Chicago, Ill., has been incorporated with a capital of $6500 to manufacture engines and tools. The incorporators are L. C. Kuhnert, S. Adler and H. L. Weiss.

The American Packless Valve & Manufacturing Co., Chicago, Ill., has been incorporated with a capital of $100,000 to manufacture metal articles. The incorporators are L. J. Kadeski, M. F. Girten and J. J. Thompson.

The Chicago Cycle Supply Co., Chicago, Ill., has been incorporated with a capital of $15,000 to manufacture bicycles and automobile supplies. The incorporators are H. P. Hanson, C. J. McMornick and R. J. Collins, 69 West Washington St., Chicago.

The Available Truck Co., Chicago, Ill., has been incorporated with a capital of $50,000 to manufacture motor vehicles and parts. The incorporators are E. F. Kings, A. H. Wiedhafft and R. C. Blume.

The Arthur McKinney Co., Chicago, Ill., has been incorporated with a capital of $25,000 to manufacture gas and electrical fixtures. The incorporators are A. McKinney, I. N. Odell and F. G. Rice, Chicago.

The Illinois Sheet Metal Co., Milford, Ill., has been incorporated with a capital of $50,000 to manufacture wood and metal articles. The incorporators are J. A. Murriett, G. F. Patterson and T. C. Herron, Milford.

The Nehring Insulated Wire Manufacturing Co., Sycamore, Ill., has been incorporated with a capital of $30,000 to manufacture insulated wire and electrical appliances. The incorporators are P. A. Nehring, J. W. Cliffe and T. M. Cliffe, Sycamore.

The Stone Hardware & Implement Co., Shawnee, Okla., has been incorporated, with a capital of $30,000, to manufacture hardware and implements. The incorporators are E. W. Stone, N. A. Stone and W. F. Stone.

The Blair Hardware Co., Blair, Okla., has been incorporated, with a capital of $20,000, to manufacture hardware. The incorporators are J. D. Tinsley, E. E. Snodgrass, H. M. Hawkins and L. Moore.

The Dow-Mirrlees-Diesel Engine Co., San Francisco, Calif., has been incorporated with a capital of $750,000. The incorporators are J. T. O'Connor and G. E. Nolan.

GENERAL MANUFACTURING

The Jones Car Door Co., Augusta, Maine, has been incorporated, with a capital of $50,000, to manufacture car doors. The incorporators are: R. S. Buzzell and L. J. Coleman, Augusta.

The Industry Novelty Co., West Mills, Me., has been incorporated with a capital of $10,000 to manufacture wooden articles. The incorporators are A. S. Emery, H. Oliver and C. C. Campbell.

The United States Envelope Sealing Machine Co., Springfield, Mass., has been incorporated with a capital of $50,000 to manufacture envelope-sealing machines. The incorporators are C. H. Davis, E. Longmeadow and C. H. Green, Springfield.

The Copethorne Demountable Rim Co., Natick, Mass., has been incorporated with a capital of $100,000 to manufacture rims, tires and wheels. The incorporators are W. E. Copethorne, H. M. Ferguson, Natick, and L. C. Smith, 613 Old South Building, Boston, Mass.

The Sanitary Paper Cup Co., Boston, Mass., has been incorporated with a capital of $150,000 to manufacture paper cups. The incorporators are G. A. Ham, 24 Milk St., Boston, and B. E. Keeney, 33 Auburn St., Melrose.

The Highland Manufacturing Co., Holyoke, Mass., has been incorporated, with a capital of $175,000, to manufacture paper. The incorporators are J. O'Sullivan, P. Judge, of South Hadley, R. B. Walsh.

The Foss Co., Springfield, Mass., has been incorporated, with a capital of $30,000, to manufacture belting and mill supplies. The incorporators are: W. J. Foss and H. J. Foss, Pittsfield.

The Hope Knitting Co., Allen St., Woonsocket, R. I., has been incorporated with a capital of $50,000 to manufacture knit goods. The incorporators are W. A. Tucker, S. W. Tucker and W. S. Hunt.

The Manahansett Manufacturing Co., Putnam, Conn., has been incorporated with a capital of $175,000 to manufacture cotton and tire cloth. E. V. Livesey, president, and W. Bamber, superintendent.

The Connecticut Crushed Stone Co., Hartford, Conn., has incorporated, with a capital of $50,000, to conduct and operate a stone-quarry plant. The incorporators are Herman V. Stoehr, Hartford; Edwin R. Morgan, Melrose; L. J. Coburn, New Britain.

The Zack Lumber Co., Brooklyn, N. Y., has been incorporated, with a capital of $10,000, to operate lumber mills. The incorporators are A. M. Zack, West Second St., Coney Island, and S. L. Cohen, 383 Knickerbocker Ave., Brooklyn.

The Hamilton Pipe Co., Brooklyn, N. Y., has been incorporated, with a capital of $50,000, to manufacture pipes and makers' articles. The incorporators are R. A. Zettnacher, B. Zeichner, 18 Sackett St., Brooklyn, and J. F. Forrester, 346 Broadway, New York.

The Krossknit Manufacturing Co., Huntington, L. I., N. Y., has been incorporated, with a capital of $50,000, to manufacture knit goods. The incorporators are S. A. Kross, 3 East One Hundred and Thirtieth St.; A. Kross, 841 Kelley St., and A. L. Brady, 416 West Forty-third St., New York City.

The Arrow Knitting Mills, New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture knit goods. The incorporators are H. Simon, B. Bangser, 200 Fifth Ave.; E. M. Otterbourg, 200 West Seventy-eighth St., New York.

The G. W. Augustin Co., New York, N. Y., has been incorporated, with a capital of $75,000, to manufacture amber and other pipes. The incorporators are C. W. Augustin, Jersey City, N. J.; C. Newman and W. H. Duffenbach, New York.

The Sanford, Bell & Lahm Co., New York, N. Y., has been incorporated, with a capital of $50,000, to manufacture billiard and pool tables. The incorporators are M. E. Sandford, New York; P. Lahm, Weehawken, N. J., and W. E. Sandford.

William H. Gough Co., Syracuse, N. Y., has been incorporated with a capital of $25,000 to manufacture electrical decorations, buntings, flags. The incorporators are W. H. Gough, H. J. Gough and S. Rosenthal, all of Syracuse.

The National Match Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture matches. The incorporators are V. C. Bagardus, A. L. Friedberg and I. Friedberg, 150 Nassau St., New York.

The Tizzani, Gartner & Russell Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture laces, embroideries and dry goods. The incorporators are Manlio Tizzani, 104 Fifth Ave.; William S. Gartner, 104 Fifth Ave., and Eliot Norton, 2 Rector St., New York.

W. G. Brown & Co., New York, N. Y., has been incorporated with a capital of $65,000 to manufacture raincoats and wearing apparel. The incorporators are W. G. Brown, M. G. Worth and J. C. Lynch, all of New York.

The Home Furniture Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture furniture and house furnishings. The incorporators are Jacob D. Goodhart, 1049 Forest Ave., New York; Chas. Strelitz, 311 East Twenty-first St., New York, and Saul B. Ackerman, 1265 Forty-ninth St., Brooklyn, N. Y.

The Transparol Products Co., New York, N. Y., has been incorporated with a capital of $100,000 to manufacture paints and varnishes. The incorporators are R. M. Travis, C. M. Scism and F. D. Clark, New York.

The Radium Novelty Co., of New York, N. Y., has been incorporated with a capital of $10,000 to manufacture cloth trimmings and novelties. The incorporators are Adelbert Krausz, 64 St. Marks Pl.; Victor Frank, 447 East One Hundred and Thirty-seventh St., and John Kruisi, 960 Prospect Ave., New York.

The Appleton Parker Co., New York, N. Y., has been incorporated with a capital of $17,000 to manufacture toilet preparations and perfumes. The incorporators are Benjamin Bag, Edgar M. Troutfelt and Henry Schwed, 2 Rector St., New York.

The Smith, Matches Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture advertising devices. The incorporators are H. De W. Smith, L. C. Smith, New York, and R. P. Matches, Harrison, N. J.

The Adams, Jefferson Co., New York, has been incorporated with a capital of $110,000 to manufacture trusses and other surgical appliances. The incorporators are Wm. S. Rice, Gertrude A. Rice and Arthur L. Rice, Adams, N. Y.

The Colonial Rubber Specialties Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture auto tires and rubber specialties. The incorporators are G. M. Post, 4 West One Hundred and First St., New York; E. F. Aird, 551 Van Cortlandt Park Ave., Yonkers, and S. Newman, 2159 Mapes Ave., New York.

The Egmont Knitting Mills Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture knit goods. The incorporators are L. Neuberger, 25 Claremont Ave.; A. J. Baylass, 302 West Twenty-first St., and D. Frank, 874 Southern Blvd., New York.

The Stone Gould & Farrington Co., New York, N. Y., has been incorporated with a capital of $15,000 to manufacture cut gravel and building material. The incorporators are E. H. Stone, 1128 Bedford Ave., Brooklyn; J. R. Gould, 12 North Ninth Ave., Mt. Vernon, New York, and F. R. Farrington, 401 West One Hundred and Twenty-eighth St., New York.

The W. Hughes & Co., Brooklyn, N. Y., has been incorporated with a capital of $150,000 to manufacture supplies used for the manufacture of paper. The incorporators are W. Hughes and P. McNiel, 84 Metropolitan Ave., Brooklyn.

The Cady Dental Co., Albany, N. Y., has been incorporated with a capital of $10,000 to manufacture dental supplies. The incorporators are B. B. Williamson and G. I. Williamson, 30 North Pearl St., Albany, N. Y.; J. F. Barringer, Poughkeepsie, N. Y.

Eastern Mill Pants Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture clothing. The incorporators are Norbert Leibel, 2086 Honeywell Ave.; Harry Ruden, 1473 Washington Ave., and Clara Leibel, 2086 Honeywell Ave., New York.

The Antario Thread Co., New York, N. Y., has been incorporated, with a capital of $15,000, to manufacture threads. The incorporators are P. Spinnel, 35 East Eighth St.; V. C. Rogardus and H. H. Wolf, 150 Nassau St., New York.

The Mechanicsville Brick Co., Stillwater, N. Y., has been incorporated, with a capital of $100,000, to manufacture brick. The incorporators are M. L. Welling, R. A. Moore and J. M. Purcell, Mechanicsville, N. Y.

FORTHCOMING MEETINGS

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

MEN WANTED

Connecticut

DRAFTSMAN AND DESIGNER, experienced, first-class (technical education preferred), possessing ability to eventually warrant promotion, by an uptodate, successful concern, building a standard line of machinery for working wire and sheet metal; one grand opening for the right man and none other need apply, otherwise it will be useless; when replying, state experience, references and salary. Box 51, Am. Mach.

Illinois

FOREMAN—A young man with shop experience and some technical knowledge of regulating and other special valves, to take a position as foreman or assistant foreman in manufacturing department. Box 34, Am. Machinist.

ALL-ROUND experienced man on radial and thrust bearings; must understand how to handle men and be familiar with the various operations and machines; state experience and salary expected; factory location, Chicago, Ill. Box 50, Am. Machinist.

Indiana

TOOL MAKER, first-class workman, experienced on small dies and jigs. Address, stating age, experience and pay required, Box 43, Am. Machinist.

FOREMAN for machine shop in factory employing 100 men; must be first-class die and tool man and accustomed to light, fairly accurate work; salary, $27.50 weekly; in applying write fully in first letter. Box 6, Am. Machinist.

Kentucky

SUPERINTENDENT—High-grade man as superintendent of large typewriter manufacturing company; must be a man of wide experience whose qualifications are such that he can command and maintain the respect of the officers over him and the foremen and other employees under him; must have the ability to direct all the manufacturing departments and must thoroughly understand the construction of tools and dies; will pay good salary; position offers great opportunity for the right man; in replying state age, experience, present employer, salary expected and how soon can report; reply will be treated in strict confidence. Box 4, Am. Machinist.

Maryland

MARINE DRAFTSMAN capable of taking off quantities and weights and preparing schedules for estimates. Address Box 33, Am. Machinist.

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

RATE SETTERS and stock keepers, first-class; write stating age, experience and salary expected. "A. S. D.," Am. Machinist.

OPERATORS — First-class automatic and hand screw-machine operators, Cleveland and P. & W. machines. Box 41, Am. Machinist.

TOOL MAKER—First-class workman required with experience in designing labor-saving tools. Address, stating age, experience and pay required, Box 983, Am. Machinist.

MACHINISTS, Three first class, accustomed to first class work; good wages and permanent position to man of executive ability; no others need apply. Address Lock Drawer 26, Boston, Mass.

Michigan

TOOLMAKERS — Several men with first-class experience on jigs and fixtures; in writing, state age and experience in detail. Buick Motor Co., Flint, Michigan.

OPERATORS—We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

Missouri

BLACKSMITH, an all-around, for medium and light job work; one who understands getting out work under the steam hammer; steady employment; open shop. Box 31, Am. Machinist.

New Jersey

TOOL DESIGNERS—Several first-class. Apply Crocker-Wheeler Co., Ampere, N. J.

DESIGNER—An A1, on heavy pumping-engine work; only high-speed men need apply. Worthington Hydraulic Works, Harrison, N. J.

New York

DETAIL DRAFTSMAN; must have had at least two years' experience. Kerr Turbine Co., Wellsville, N. Y.

DROP FORGE DIE SINKER wanted; man with experience on close and accurate hob or type work preferred; none but men of experience need apply; central New York. Box 45, Am. Machinist.

SALESMEN—A prominent maker of air compressors is in need of three experienced and efficient salesmen; state in detail previous experience, references and compensation expected; answer in hand writing. Address "Compressor," Box 26, Am. Machinist.

YOUNG, energetic man, with fair knowledge of drafting; capable of figuring weights and quantities from blueprints and to make himself generally useful in growing manufacturing concern in Brooklyn, N. Y.; give full particulars as to age, experience and salary expected. Box 44, Am. Machinist.

SUPERINTENDENT of electro-chemical and machine works, a man of experience, who is willing to grow up with a young company in a promising industry; should be familiar with the handling of various gases: oxygen, nitrogen, hydrogen, acetylene and the apparatus for the same; write fully, stating experience, reference and salary expected. Address "C. P. M.," Room 443, 30 Church St., New York City.

FOREMAN to take charge of machine shop doing a general line of moderately heavy work; to qualify one must be thorough mechanic, used to uptodate tools and machines, able to handle about 75 men, and get results promptly; residence in town where shop is located imperative; location 12 miles from New York City; state experience fully, age and salary expected. Box 30, Am. Mach.

Ohio

SUPERINTENDENT or manager, with $14,000, to take 51% of the stock in a machine tool company; old established trade, building lathes; a rare opportunity; building and grounds owned by company. Box 46, Am. Machinist.

MANAGER for machine shop, thoroughly familiar with Corliss pumping machinery and air compressors; must be a mechanical engineer, technical graduate, with both selling and shop experience; give reference, state age, experience and salary required. Box 8, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

LATHE HANDS and tool setters, Potter & Johnston automatic. Apply to employment department, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

MACHINISTS—Do you want to earn a day's pay during the noon hour? We are offering big inducements to hustlers in every machine shop in the country; a bonafide business proposition; no triflers need apply; write for particulars. Alert Tool Co., 221-223 N. 23rd St., Philadel-

DIE MAKER, sheet metal; must be skillful and able to design intricate labor-saving dies and get work out quickly; wages, $5 to $6 per day; un-

limited advancement to man of skill and energy with progressive concern; full particulars and references required. Box 42, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Virginia

MECHANICAL DRAFTSMAN — One third-class, at $4.48 per diem; a competitive examination will be held at the Navy Yard, Norfolk, Va., Mar. 7, 1912, for the purpose of filling the above position. For further information address Commandant, Navy Yard, Norfolk, Va.

POSITIONS WANTED

California

DESIGNER—Mechanical engineer from the East, middle aged, married, desires position in California as designer or chief draftsman; thoroughly familiar with uptodate shop methods and handling of men; factory experience; expert tool designer; A1 references from most prominent concerns; connected with present firm 11 years. Box 3, Am. Machinist.

Illinois

ASSISTANT SUPERINTENDENT or foreman of machine tool firm, an American, 28 years of age, good habits and health, expert on gearing and rapid machine production, tool and jig making, desires change; Pacific Coast or Southwest preferred. Box 29, Am. Machinist.

DEMONSTRATOR and machine tool representative of broad practical and technical experience, an American, 28 years of age, expert on gearing and high speed machine tools, desires change; Pacific Coast or western states preferred. Box 28, Am. Machinist.

Massachusetts

FOREMAN PATTERNMAKER, with 20 years' experience in various lines, desires change; best of references. Box 40, Am. Machinist.

SUPERINTENDENT — Mr. Manufacturer, could you utilize my experience as superintendent or assistant, general foreman or draftsman in the metal trades? Age, 34; 14 years' practical experience as mechanical engineer; competent and reliable; 10 years as draftsman on special and automatic machinery, jigs, etc.; am thoroughly familiar with shop methods and the interchangeable manufacturing business. For interview address Box 47, Am. Mach.

Michigan

TOOL DESIGNER — German college graduate, for five years with the first automobile concern in Germany as foreman and assistant superintendent, for two years with large American auto company as tool designer, thoroughly practical man, wants responsible position in shop or drafting room. Box 36, Am. Machinist.

New Jersey

MECHANICAL ENGINEER, graduate, thoroughly understanding the design and manufacture of electric commercial vehicles, desires position; age, 27; married. Box 5, Am. Machinist.

DRAFTSMAN—Young man, graduate civil engineer, Brussels University, wishes position as assistant or draftsman. Address "Fischer, 238 Cleveland St., Orange, N. J.

MECHANICAL ENGINEER, chief draftsman and designer; age 40; technical and practical; experienced on hydraulic, general machinery, power plants, etc., is open for engagement in the metropolitan district; reference A-1. Box 32, Am. Machinist.

SUPERINTENDENT, general foreman, or foreman of tool department; I would like to correspond with companies having a position open in this line; have been handling help for the past eight years; am expert on designing and making press tools. Box 53, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 48, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DESIGNING DRAFTSMAN, special and automatic machinery, development of ideas, wishes a situation. Box 52, Am. Machinist.

PLANER and machinist, first-class, desires employment from Mar. 11; English; any state; good all-round experience. Box 39, Am. Machinist.

A-1 MECHANIC, gang-boss or assistant foreman; am 14 years in the business, engines, pumps or electrical machines. Box 2, Am. Machinist.

GENERAL SUPERINTENDENT and manager of large successful concern desires change; nine years in present position. Box 10, Am. Machinist.

DRAFTSMAN, 3½ years' varied experience, wishes to secure permanent position with opportunity of advancement. Box 27, Am. Machinist.

MECHANICAL ENGINEER — Skilled mechanic, with 15 years' broad experience in designing of tools, efficiency methods and manufacturing, desires position. Box 49, Am. Machinist.

MECHANICAL DRAFTSMAN wants change; ten years' all-around experience, experimental and manufacturing, on fine accurate government work in well known shop handling extensive contracts with navy department. Box 25, Am. Machinist.

FACTORY MANAGER or superintendent, by an experienced mechanic; have had 15 years' experience on small interchangeable parts; last five years in charge of production in factory employing 250 hands; understand systematizing; am now employed in position held for last five years and can give best of reference. Box 11, Am. Machinist.

MECHANICAL ENGINEER, with an organization where merit will be permitted to produce its legitimate results; by a mechanical engineer now employed, who has the ability and confidence to use it, and whose education and mechanical training for the past 18 years have fitted him for a responsible factory position, either in full charge of a medium sized factory or as engineer, superintendent or other equally responsible position in a large factory; good executive and organizer, thoroughly familiar with best shop methods of manufacturing and management; specialty: automatic and special machinery, small tools and interchangeable manufacture of high grade products, such as firearms, cashiers, engineering instruments, bicycles, etc. Box 35, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience. "J. A.," Am. Machinist.

Pennsylvania

SUPERINTENDENT, shop or factory, experienced in modern machine shop practice, specialist on tools and reducing cost, desires change. Box 24, Am. Machinist.

SUPERINTENDENT — Mr. Manufacturer, the reason that you cannot fill your orders with your present equipment is largely due to poor shop management and lack of ordinary system; my record as a superintendent shows results and not excuses under adverse conditions; age, 35; married; temperate and a thorough mechanic; would sever connections for something more attractive; location immaterial. Box 37, Am. Machinist.

Rhode Island

TOOL DESIGNER, superintendent; a New York man having a successful record as production engineer with a large Eastern corporation, wishes to correspond with a leading concern, where ability and push are qualifications; 17 years' wide experience as machinist, draftsman and executive on light and medium weight machinery; a genius in his line; up to the minute on modern production methods, and an efficient handler of men. Box 38, Am. Machinist.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

To Let—Factory property, Plainfield, N. J.; 15,000 sq.ft. Apply A. J. Brunson, 111 East Front St., Plainfield, N. J.

Two overhead electric traveling cranes, 50-ft. span, from ten to twenty-five ton capacity, either new or second hand, wanted. Bertsch & Co., Cambridge City, Ind.

For Sale—Friction pulley and universal grinding attachments patent for sale; also Canada patent outright. For full particulars address R. Rosner, Madison, Wis.

For Sale — Bargain, machine shop, small metal work; complete nickel-plating plant and equipment for cabinet work; 12,000 sq.ft. in operation. Machine Co., 1131 South Broadway, St. Louis, Mo.

For sale, a brand new Brown & Sharpe No. 13 bevel gear cutter; also a new 36-in. Bullard turret lathe. Address "Machine," Post Office Box 726, Detroit, Mich.

Largest cutter and drill maker in the United Kingdom, with large works and show rooms, desires few good sole agencies, such as micrometers, center drills, ball bearings and kindred lines. Box 22, Am. Machinist.

Draftsmen, mechanics, engineers, draw an ellipse by quick new method; instantaneous; accurate; any size; 50c. postpaid; worth fifty times cost; if not pleased will refund money. B. F. Crawford, L. Box 334, Brazil, Ind., U. S. A.

We are open for propositions on welding and cutting appliances for all gases. Wish to hear from inventors, manufacturers or practical constructors of torches, regulators, acetylene-gas generators, etc. In writing, give experience with apparatus and results obtained. Address C. P. M., Room 443, 30 Church St., New York City.

Machine tools and small tools—Alfred Herbert, Ltd., Coventry, having an extensive organization and a large staff of salesmen specially engaged on machine tools and small tools in Great Britain, France, Germany, Italy, Switzerland, Belgium, India and Japan are open to handle good agencies of all kinds and invite correspondence with manufacturers.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

For Sale—A prosperous machine metal working and tool plant; equipment complete, including wood-pattern department; excellent location in N. Y. City and a going business; will require about $15,000; will deal with principals only; excellent reason for selling. Earl A. Bowman, 416 Broadway, N. Y. City.

Mechanical engineer, Frenchman, age 30, partly educated in England, also well up in American methods, has had first class training; technical, shop, D. O. and sales; common sense, energetic business man; speaks, corresponds perfectly in both languages; also translates all technical matter pertaining to the mechanical and electrical industries; wishes to make arrangements with sound American firm manufacturing machine tools, tools or any other mechanical appliances of a very practical and original nature, and desirous of introducing their goods in France. Write. Mandat, Poste 093, Bureau 26, Paris.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

Did you ever realize that lots of people spend more time on the ads in certain papers than on the reading section?

It's a fact. There are several reasons why it is true.

Mayor Gaynor, of New York City, in a speech recently made before the Advertising Men's League of New York, said that when he picked up certain magazines and read through the articles in them, it was a relief to turn over to the advertisements. What he meant was that the advertisements were more interesting.

An ad is short, it has only one idea, or two or three ideas, at most, and these ideas have to be expressed as clearly as words can make them. The real crack-ajack ad has just one single idea. That idea is told in so clear, direct, get-to-you way that it fairly sticks out of the page.

So many good ads of this kind are being written today that the advertising pages of some magazines, taken as a bunch, are actually more interesting, as well as more valuable than the reading pages, and probably some people buy some papers more for the advertisements than anything else.

It is not so true of a good technical paper—a business paper—like the AMERICAN MACHINIST, of course.

The articles and departments of a paper like the AMERICAN MACHINIST, besides being more permanently valuable than the ad section, are just as immediately indispensable and interesting.

But—

This shortness of the ads, compared with the articles, the easiness with which one can grasp the idea in a good ad, give the ad section an advantage for reading at certain times.

This was brought out by a superintendent in Philadelphia the other day. He was standing beside his desk, on which was spread open at the advertising section, a much thumbed copy of the AMERICAN MACHINIST.

"You see," said this superintendent, "a fellow in charge of a big shop, like I am, hasn't a lot of spare time. But in the between times, here and there, I can read an ad or two, and then turn over the idea in my mind as I work. Later, I come back and read another."

"I carry the AMERICAN MACHINIST home to read the articles. They take more unbroken time and concentration than I can give down here."

Probably you have found out the same thing as this superintendent. If you haven't, try it. See how the ads fit in with spare minutes. They're built to do just that thing, and then give food for thought as you work.

* * *

Only reliable products can be continuously advertised.

Methods of an English Motor Shop

By I. W. Chubb

The methods employed in the manufacture of 4-cylinder 15-h.p. motors: the machining operations, testing, materials, shop routine, etc.

The firm of Brazil, Straker & Co., Ltd., Fishponds, Bristol, Eng., is among the few British firms manufacturing under the same roof pleasure cars, two-cylinder commercial vans and 40-hp. chain-driven omnibuses for the London streets. These vehicles are manufactured for and sold by Straker, Squire, Ltd., of London. The pleasure cars, limited now to 15-hp. cars, are put through in batches of 50, the omnibuses in tens and the vans as ordered, but mostly in twenties. Practically the whole of the work is undertaken by the firm, including even the construction of radiators. This article, however, is most concerned with some of the methods employed in connection with the four-cylinder 15-hp. Straker-Squire chassis, the one pleasure vehicle made. This indeed is the main business.

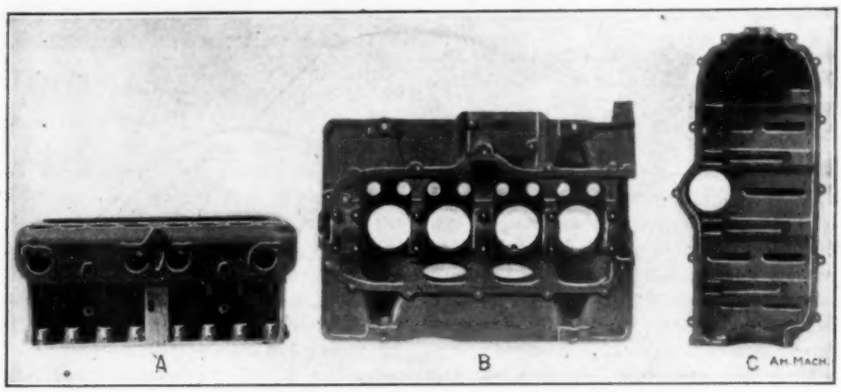


FIG. 1. FINISHED CYLINDERS AND CRANKCASE

With less than 200 in the motor department in 1908, the firm now employs about 540 men and, excepting for special jobs, runs the special premium system of payment mentioned further on. The staff is timed in and out on the Dey machine, which records in red at three minutes past the hour. A messroom is provided, managed by the men, but the tariff is passed by the works manager.

Hand-forged work is avoided and the smithy is used only for odd jobs and repairs. Stampings take the place of forgings and are used even for crankshafts; these are of chrome-nickel steel and are not machined except by grinding. The shops are provided in the usual way by processes and are run by five individual gas engines. The machines employed are, of course, chiefly English and American, plus a few French tools, as the Lejeune tooth rounder and the Lubin & Weiffenbach castellating machine. For cutting off bars, etc., saws are found cheaper than parting machines.

THE GEAR PRACTICE

Gears are broached in a special machine and this and the castellating machine render the gear system interchangeable. The practice in the shops is to rough out spurs in a No. 3 Brown & Sharpe gear cutter, finishing in the Fellows gear shaper, while roughed-out bevels are finished in the Reinecker machine. Helical gear for timing, etc., is cut in the hobbing machine.

The speed gears are assembled in their boxes and are run in under load. Each gear box is placed on a frame in the running-in department, so that the gears may be heard under actual running conditions. This method is found far preferable to using wooden blocks, which tend to deaden the noise. From experiments it has been found undesirable to make a practice of using abrasives for grinding in the gears. Success is found in very careful cutting and heat treatment; but in certain instances a mixture of fine carborundum powder and oil is used to run-in a pair of gears for a few minutes.

It is, however, fatal to use this mixture for more than a short time, as if the process of grinding is extended beyond the time when the correct note is obtained, the gears will rapidly go back in quality, and become more noisy than before being ground. Experience alone can determine just when a pair of gears may be improved by grinding, and how long to continue the process.

THE CYLINDER

Turning to the cylinder and crankcase, illustrations of the finished articles appear in Fig. 1. The monobloc cylinder *A* has the valve guides and tappet housings cast integral, while *B* shows that the crankshaft has five bearings, the view being one of the top half of the crankcase looking from the bottom side. The bolts holding the bearing keeps pass right up through the case and are used for securing the cylinders in position. At each bearing housing the case is webbed right across, giving a rigid design free from whip. At *C* is seen the bottom half of the case and the oil troughs and hole for the oil pump.

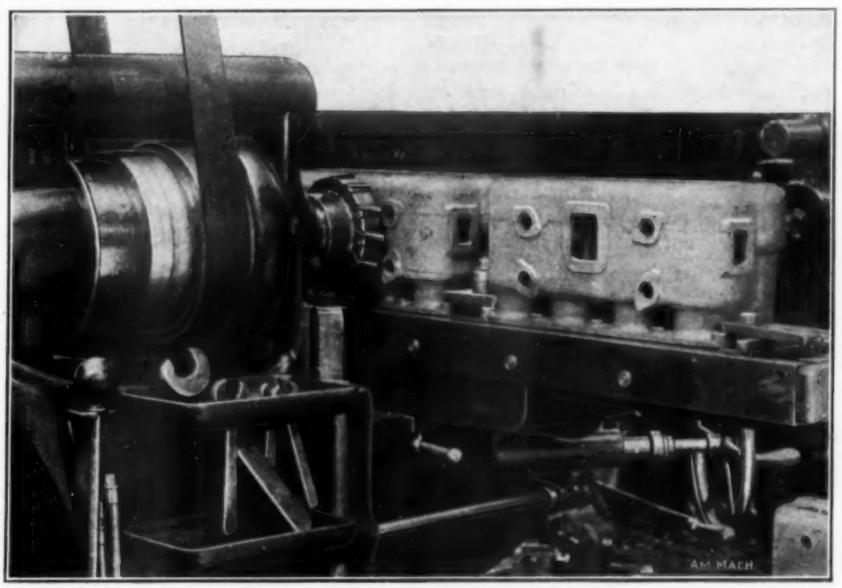


FIG. 2. MACHINING CYLINDER CASTINGS

The cylinder castings are made from a metal pattern and, after being pickled, are mounted on a Herbert plain miller so that the four faces may be machined by a large inserted-tooth cutter as illustrated in Fig. 2. The time allowed is four hours. Each casting is then drilled at the bottom face and is passed to a 5-ft.

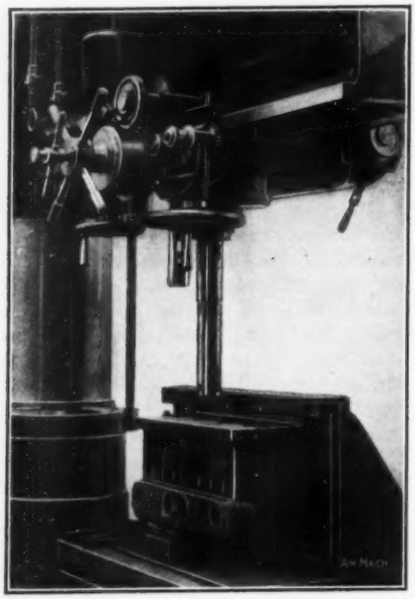


FIG. 3. BORING CASTINGS IN A RADIAL DRILLER

Asquith radial drill, Fig. 3, for boring. The illustration shows the jig employed. The four bores are machined here to within 0.01 in. The time allowed for setting up and machining is 4½ hours.

The cylinders are then ground on a Heald machine, as shown in Fig. 4, dust from the grinding being carried up through the roof by the pipe *A* and a blower. Time allowed for grinding is four hours. The firm is constructing a special machine for boring all four holes simultaneously which is expected to reduce the time considerably.

The final operations are drilling and tapping. These are carried out on a 3-ft. radial, Fig. 5 illustrating the jigs used. A box jig is not employed here, plate jigs being preferred as more economical for a given outlay; for should cylinders be urgently needed it is possible to devote three or four machines to drilling the castings, whereas this would hardly be possible with a box jig.

All holes are spotted from the bores of the cylinders by means of bungs. In the illustration *A* is a jig for drilling and tapping for valve guides, valve cover holes, and holes in the cylinder heads, also water pipes and inlet pipes. The bushing *B* supports the long drill used for the valve guide, while the jig *C* is for drilling the bottom face, and the jig *D* for drilling the valve tappet housings. The time allowed for drilling the cylinder is 14 hours, and it is found that the workman usually makes time-and-a-quarter on the job.

THE CRANKCASE

The top half of the crankcase *B*, Fig. 1, is cast in aluminum and trouble is taken to get accurate machining. The illustration, Fig. 6, of the first operation, namely milling, is of interest as it shows one of two Redman planers which have been converted to plano-milling for gear boxes and crankcases. Although obviously not specially designed for the work, they save fully 50 per cent. in time as compared with the old method of planing.

The drive to the vertical spindle is by means of a worm gear, itself driver from a pulley on the crossshaft. The inserted-tooth cutter *E* is used for top and bottom faces and the end mill *G* for milling the step for the crankshaft bearing keeps. The time allowed for all milling operation is 8½ hours.

The case is next drilled for the main bearing keeps. It passes on for the boring of crankshaft and camshaft bearing holes in a two-spindle horizontal machine, four hours being allowed for boring. The holes for the magneto shaft are also bored here.

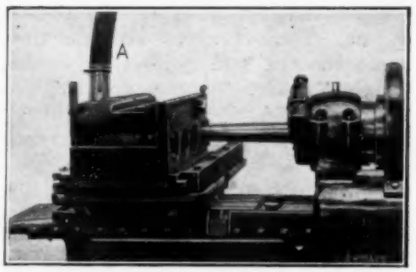


FIG. 4. GRINDING THE CYLINDERS

The two boring bars drawn out are shown in Fig. 7. The top one has, ready set up, the four single-point tools H^1 to H^4 for boring the main bearing holes and the five end mills K^1 to K^5. Thus the four crankshaft bores and the five faces can be machined at once. The end mills for facing are considered unusual for the work and are of the inserted-blade type. The actual time taken for boring the case is just a trifle over three hours, while previously on a single-spindle machine nine hours were required.

The case is next sent to the drill press. Fig. 8 illustrates the jigs used. At *L* is a drilling plate for the timing gear end of the crankcase; at *M* is the main drill-

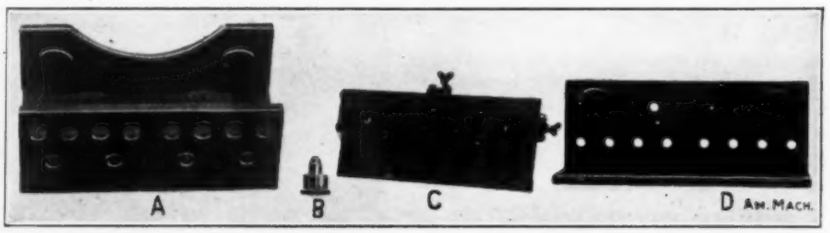


FIG. 5. JIGS USED FOR DRILLING AND TAPPING

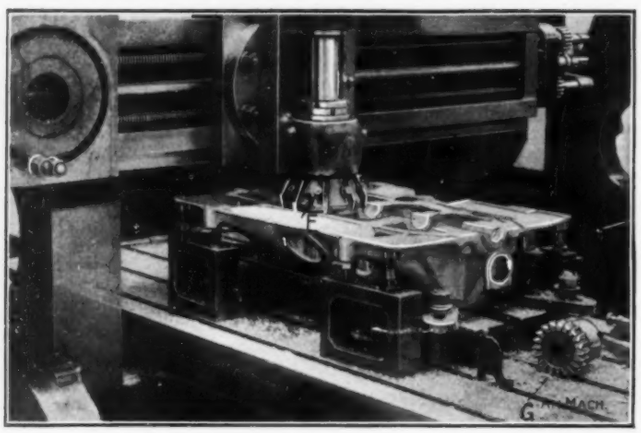


FIG. 6. MILLING THE CRANKCASE

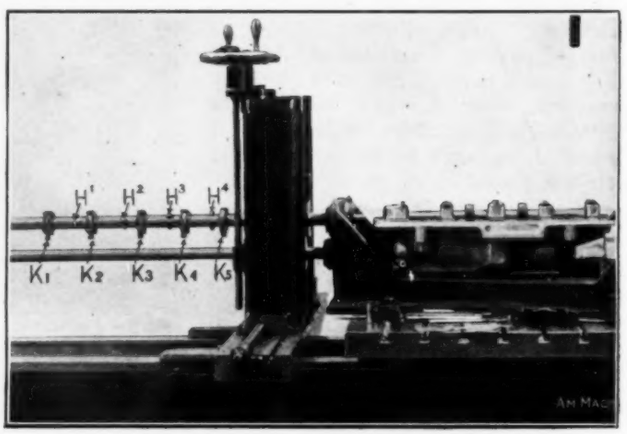


FIG. 7. TWO-SPINDLE HORIZONTAL BORER

ing jig plate for the bottom side of the case; *N* is the drilling jig for the pump cover; *O* is the jig for the magneto wire support and *P* the jig for the top side of the case. The time allowed for all drilling operations here is 10 hours; the time taken is 7½ hours. The holes are produced with the Pratt & Whitney or, as it is known in England, Vickers' twisted drill, which is found very suitable.

The Pistons

In Fig. 9 is shown the Pittler lathe set up for machining the 15-hp. pistons, 3.42 in. in diameter. The finished piston is seen lying on the circular turret. The ordinary piston is made of very hard close-grained iron, which is found particularly severe on tools while machining. The time allowed for turning, etc., is one hour. The actual time taken is 45 minutes, including the work of turning, inside and out, making piston-ring grooves and crowning.

The weight of the finished cast-iron piston is 2 lb. 1 oz. A racer piston turned from the solid steel weighs 1 lb. 1 oz. This work could be produced on the Potter & Johnston machines in 20 minutes, but these are fully occupied otherwise.

The Cams and Shaft

The cams for operating the valves are integral with the shafts on all engines. Fig. 10 shows the stamping in the rough and also the finished shaft below. The cam miller illustrated in Fig. 11 is used and a jig is employed for testing the timing before the cams are passed. Fig. 11 illustrates the shaft being ground after hardening, but the stamping goes through the same machine for milling before the hardening process. The camshaft is rotated between the headstock and tailstock of the machine and is driven by the key on the end, which is used afterward for the timing wheel.

At the back of the machine is a countershaft carrying the master cams, against which rollers press and thus give reciprocating motion to the tool slides carrying the milling cutter and grinding wheel. About 0.01 in. is left on the cams for grinding after hardening.

The operations are as follows: 1, Rough machine shaft in center lathe; 2, keyway on end of shaft; 3, on miller cut spiral gear for pump; 4, mill cams in cam miller; 5, carbonize shafts; 6, return shafts to center lathe and turn out carbon between cams to facilitate straightening; 7, reheat shaft and dip out; 8, grind bearings on plain grinder; 9, grind cams on special machines. The time allowed is 8½ hours and time-and-a-quarter is made.

The splining or castellating machine, Fig. 12, is used for all splined shafts, including the first- and second-motion shafts in gear boxes and all back axles and propeller shafts. In operation it is found to be about half as fast again as milling with a formed cutter; the tools are simple and the results accurate.

Detachable hubs are illustrated in Fig. 13, *S* being machined on a Potter & Johnston tool. The operations include holding the hub in the chuck, facing the back and boring the inside to take ball races, turning the hub round and machining the outside, including the taper; the total time being 45 minutes, which compares with 5½ hours, the previous best time on a center lathe.

The Test Shop

The test shop is shown in Fig. 14. After erection all engines are run in on belt for three hours. They are then transferred to the engine-test stands as shown, where they are run for four hours on coal gas. If the engines are then found satisfactory, the carburetors belonging to them are coupled up and a power test is taken, compression and explosion pressures being noted.

Next the engines are entirely dismantled. Every part is examined with the utmost care. All bearings are gone over and the engines are re-erected. The valves are ground in and fresh oil is put into the sump. The engines then have their final test. Each one has to come to a given standard before it is allowed to pass out of the test room and a full

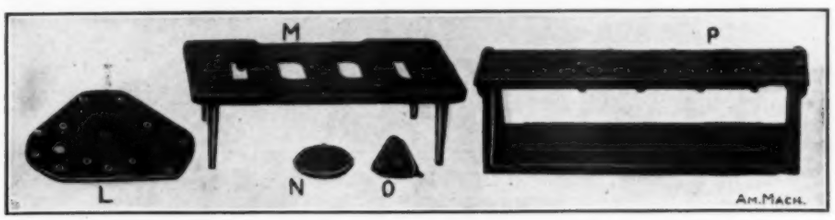


Fig. 8. Jigs Used in Drilling Crankcase

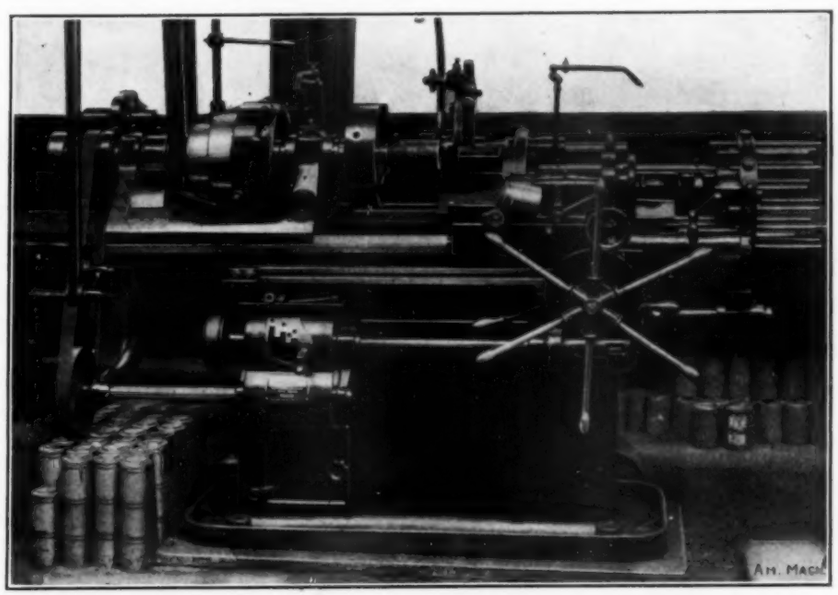


Fig. 9. Lathe Set up for Machining Pistons

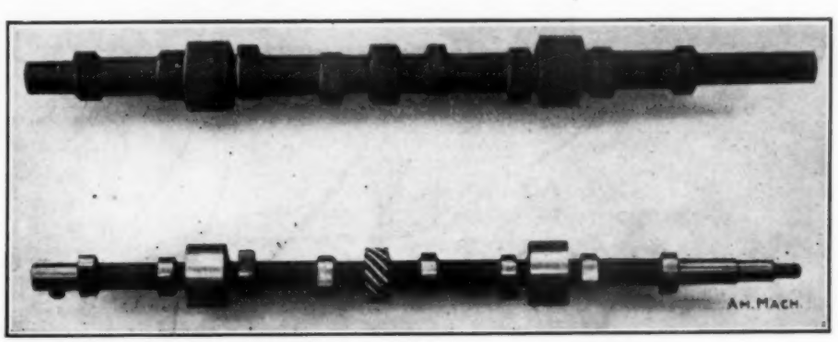


Fig. 10. Camshaft for Operating Valves

report is made on each engine and filed for reference.

The Materials Employed

Materials employed include, for special gears, Bischoff B. N. D. air-hardening steel, a German material. Muntz aluminum is employed, containing 93 per cent. Stampings for connecting rods, starting levers, etc., are of 60 tons tensile steel. All shafts are of oil-tempered nickel steel, while the back axle bevels and differentials are of Vickers' chrome-nickel steel. All malleable material is in steel alloy, and Richards plastic white metal is used for bearings.

The Office Methods

A note on some of the office methods may interest. With each new model, the drafting room produces a specification which is divided up, with the parts scheduled. The order section then requisitions the machine shop for the number of specific parts repaired on a works-order card, which goes right through with the job. It is signed for by the men when the material goes into the shop before starting, and checked after each operation.

Supplementary works-order cards, colored pink, and of exactly the same kind, are issued in the case of an original works-order card (colored green), having to be split up, or a part of a batch rushed through. Special replacement cards, colored orange, for spoiled work are issued as needed from the inspection room; this set of three works-order cards looks after the proper costing of a particular batch, and avoids leakages.

Periodically, for instance, each month, it is possible to determine exactly what each department has produced in the way of spoiled work. A special "lightning" card is used when replacing worn parts in old-type motors or in motors in out-of-the-way places; should these parts not be in stock. This card has to be signed for by the workman on penalty of discharge. With the progress card the workman is given a bonus ticket with a description of the job, operations, batch, price allowed, etc., on it. The job is checked and timed on and off at the back. The color of the card varies with the shop.

The Drawings

Only one copy of each drawing is allowed to circulate in the shops. Therefore, no confusion occurs in regard to replacements or alterations. The inspection room is connected with the drawing stores and each part is sent back to it and checked after every operation. Each detail is shown on a separate print which is mounted on cardboard and varnished. General arrangement drawings are mounted on rollers, and for all drawings the workman has to give up a check. Blueprints on cloth are usual.

The drawings of details merely indicate various classes of fit for various parts without giving actual dimensions. Each kind of fit has its own symbol. For instance, *H X* equals a press fit, *F X* equals a force fit, and so on. The Newall

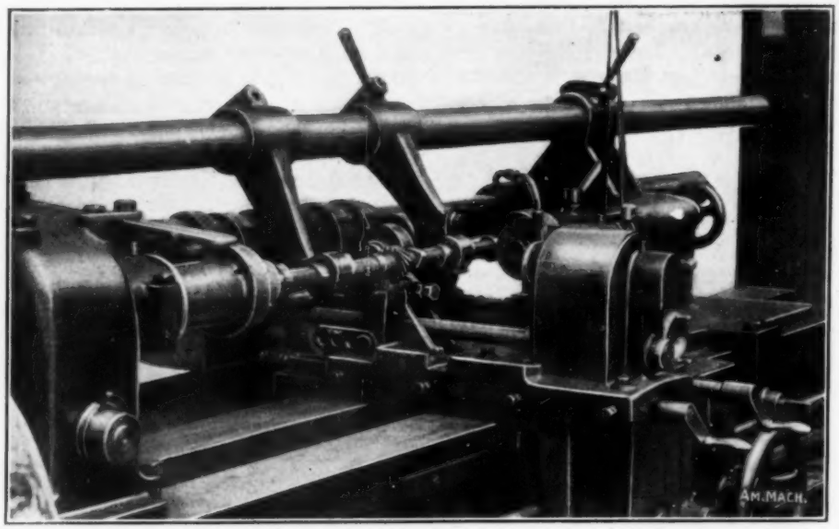


Fig. 11. Grinding the Camshaft after Hardening

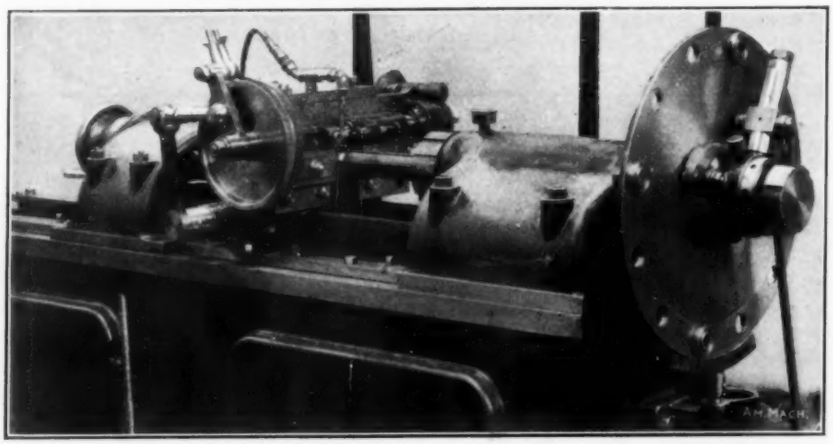


Fig. 12. Splining or Castellating Machine

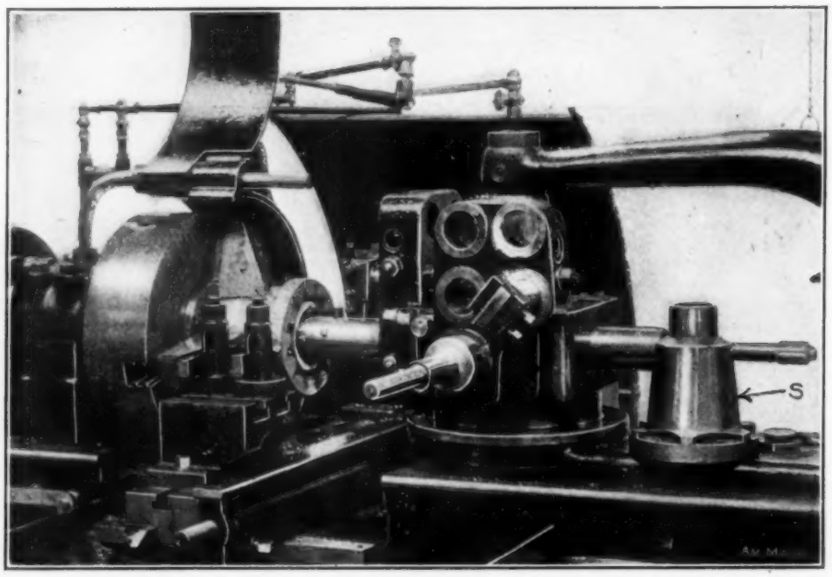


Fig. 13. Showing Detachable Hubs

No. 2 system is employed throughout the shops, micrometers being used for outside work, and plug gages for inside work. A workman is given a table of limits on a separate card from which he works, noting the kind of fit desired as shown by the general drawing.

FIG. 14. THE TEST SHOP

THE TOOL STORE

The tool store is divided off from the toolroom, but connected therewith. All tools, jigs, etc., are, of course, kept in the tool stores, and a workman must deposit a check before he may take out a tool or jig. When this is returned to the inspection room, it is handed to an inspector to be looked over before being returned to its proper place. Should it be found defective, it is returned to the toolroom to be put right before being stored away. The toolroom staff is on day work, owing to the constant variation of jobs. Every workman before he receives his pay on Saturday, must have returned all small tools, cutters, gages, taps, etc., to the tool stores.

SYSTEM OF KEEPING THE VARIOUS COSTS

To keep the cost of renewals and repairs, etc., the head of each department is provided with a manifold book, a different color being used for each department. When an addition or repair is required the head of the department makes out a requisition and passes it on to the toolroom foreman. Before being put into operation this requisition must be signed by the works manager. The requisition acts as a voucher to the order department and follows the job right through until completed. The head of the department finally signs the requisition if the work is satisfactory and it is then passed to the cost office.

WAGE PAYMENT

Finally as to the bonus system. This is based on price, not time. It is nearly two years since the management concluded that to cope with both competition and to manufacture in quantities it was desirable to introduce a premium or bonus scheme if workmen were to be encouraged to greater efforts. At first the idea was opposed to some extent by the heads of the firm, on the grounds that the works were in a district in which this form of remuneration was unknown and that the work people were decidedly conservative. Their fears were well founded.

After trial and modification, however, the scheme proved a decided success, for it considerably increased the output and the work people are now entirely in its favor. At first the Rowan system was adopted. Many of the men, however, could not understand the percentage scheme and as a result it was decided to change to a price per piece system. In any saving of a stated price, reckoned eventually on time, the man takes three-quarters and the firm takes a quarter. Directly the change was made a marked improvement was noted in the attitude of the men. They could understand what was being done.

IMPORTANT CONSIDERATIONS IN OPERATING THE PREMIUM SYSTEM

The exact net gain cannot be estimated yet. The scheme has naturally entailed expense, which, however, can be spread over a considerable period. It was necessary, for instance, to build a bonus office, engage an extra clerical staff, print special forms and install adding and time-recording machines. The experience of the firm has shown that in introducing a bonus system, it must be as simple as possible, and above all the men should understand it. Skill and tact must be employed in pricing or timing, and prices must not be changed without proper and just explanation being made to the workman in a candid and aboveboard manner.

Rollers for Expanding Hydraulic Cylinder Liners

BY E. A. DIXIE

Many hydraulic cylinders are lined with copper. The cylinder is first bored, then the copper liner is pushed in; it must be an absolutely tight fit, so that no water can leak in between it and the casting.

The making of these cylinders is an everyday job at the Waterbury Farrel Foundry, Waterbury, Conn. The tools shown in the halftone are those used for the final rolling in of the copper shell. The roller to the right is mounted on a 3-in. square bar of steel, about 4 ft. long.

It is held in the tool post of the big lathe and by means of the crossfeed the roller is brought in contact with the inside surface of the copper shell.

The long feed is then started and the copper—squeezed between the cylinder casting and the roller—expands and becomes almost a unit with the cylinder casting.

The feed is used in one direction only; when the bottom of the hole is reached the roller is released from contact with the copper, and the carriage is run back by hand. Several passes are necessary to complete the job. As the copper also stretches endways, it is forced snugly against the bottom of the cylinder casting when it has a flange, but in the case of an open cylinder, the copper liner stretches out beyond the ends. The amount of this stretch will be as much as 1½ in. in 12 in. The edge of the cylinder being chamfered, the copper is rolled over this chamfer and then turned flush with the face.

ROLLERS FOR EXPANDING HYDRAULIC CYLINDER LINERS

The triple roller shown to the left is used for small cylinders of considerable depth. Each of the dovetailed jaws carries a roller. Adjustment of the rollers is obtained by means of setscrews between the central cylindrical stub and each jaw. The triple roller head is mounted on a shaft of suitable length, and except for the crossfeed is used in a similar manner to the one just described.

Recent investigations have shown that the electrical conductivity of metallic sodium is 30 per cent. greater than that of potassium. Sodium has about one-third the electrical conductivity of copper.

Tools for Adding Machine Work

By F. A. Stanley

Press tools for blanking and piercing plates and an indexing die which punches a series of oblong openings, one row at a time.

Jigs and fixtures for profiling, drilling and assembling various parts. An indexing jig for tapping a die-cast member.

General tool-room features of interest.

In an earlier article on the Dalton Adding Machine Co.'s plant, at Poplar Bluff, Mo., a number of special jigs and fixtures were illustrated, but lack of space made it impossible to include more than a few types of these tools, consequently some interesting manufacturing appliances and methods remain to be illustrated, and these are included in the present article.

The illustrations, Figs. 1 and 2, should be of interest, as they give a general idea of the simple arrangement of mechanism in the Dalton machine. The two models photographed for these views, show the mechanism in two positions, one normal, the other set to print the character "5." The knobs on the sides of certain levers are merely to facilitate the operation of the models for demonstration purposes.

The group of parts constituting the model comprise the mechanism for adding a single column of figures, and may be considered as a single unit, nine of which are required, side by side, to make up the operating mechanism inside the adding machine proper for nine-column computations.

A Few Features of the Machine

Without attempting to describe the machine in detail, it may be stated that it is an adding, listing and calculating machine, with, apparently, almost unlimited possibilities in the handling of computations involving addition, subtraction and multiplication, and, furthermore, it is of aid in division, though no claim is made for it as a dividing machine.

When these facts are taken into consideration, one cannot fail to be impressed with the simplicity of the apparatus by which such results are obtained, for there are only 15 keys to be operated, 10 of the numerals, 0 to 9, one for totals, one for corrections, one for repeating, one for eliminations, and one for designating desired items. These keys are arranged for easy operation by the touch method, and little mental effort is required for the correct and rapid manipulation of the keyboard and the operating lever at the right side of the machine.

Each item, as set up by the keyboard, is printed on the reel of paper at the top when the operating lever is pulled. The return stroke of the lever actuates the accumulating mechanism, which enables the total output to be printed when the lever is pulled down after the totaling key is depressed.

Some Operative Details

Referring now to Figs. 1 and 2, it is an easy matter to understand the means by which the type bars and accumulating wheels are actuated. At *A* in each view will be noticed a set of stops from 0 to 9, all of them movable radially in their sockets, with the exception of No. 9, which, being the inner end of the series, marks the limit of throw of the oscillating lever *B* and toothed sector *C*, and therefore requires no sliding movement.

The stops are controlled by the keys, and if the key for the figure 5 is depressed, No. 5 stop is thrown up into operative position, as shown in Fig. 2. Now, when the lever at the outside of the case is pulled down, sector *C* is moved forward until its stop comes into contact with stop No. 5, Fig. 2, and in this position, the character "5" on the type bar *D* is directly opposite the center of the platen *E*, and in position for printing.

The movement of the operating lever, which brings the type character into place for printing, also causes the corresponding hammer to strike the type and make the impression upon the paper. As the operating lever returns to normal position, cam *F* swings backward, as in Fig. 1, and allows the accumulating wheel which it controls to rise into contact with the toothed sector *C*, which in turn rotates this wheel through a distance equal to five teeth. When the segment rises for the next item in the column of figures, it advances to the predetermined

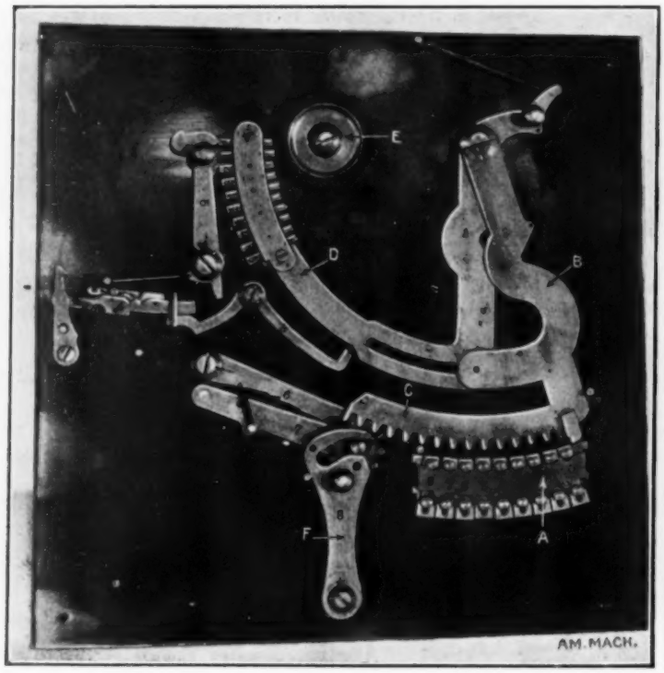
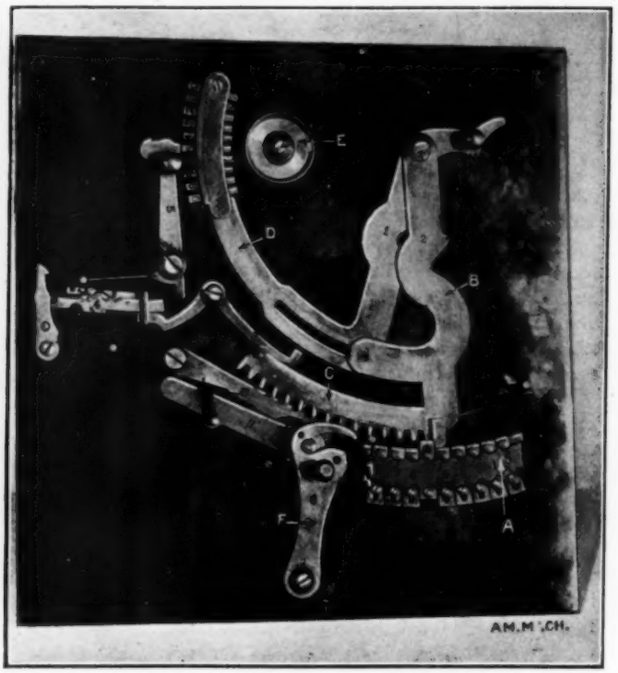


Fig 1



General Arrangement of Mechanism in Dalton Adding Machine Fig. 2

point, as established by the stop in block *A*, the figure is printed under the figure 5 and the accumulating wheel moved ahead a corresponding number of teeth. The system of wheels controlled by the series of sectors automatically gives the setting of the mechanism for the printing of the total at the bottom of the column of figures.

as the single-place quantities are dealt with.

Some Press Tools

The illustrations just referred to give an excellent idea of the character of the punch and die work that is required in the manufacture of the adding machine. Certain of the press tools which gang cutters to provide narrow retaining grooves and ribs in register with each row of slots. The plate is bent to the correct curvature after the piercing operation, and a double-width plate (for an 18-column adding machine) is shown at *A*, as it appears when milled and formed to shape.

The stope carrier at *B*, is shown in

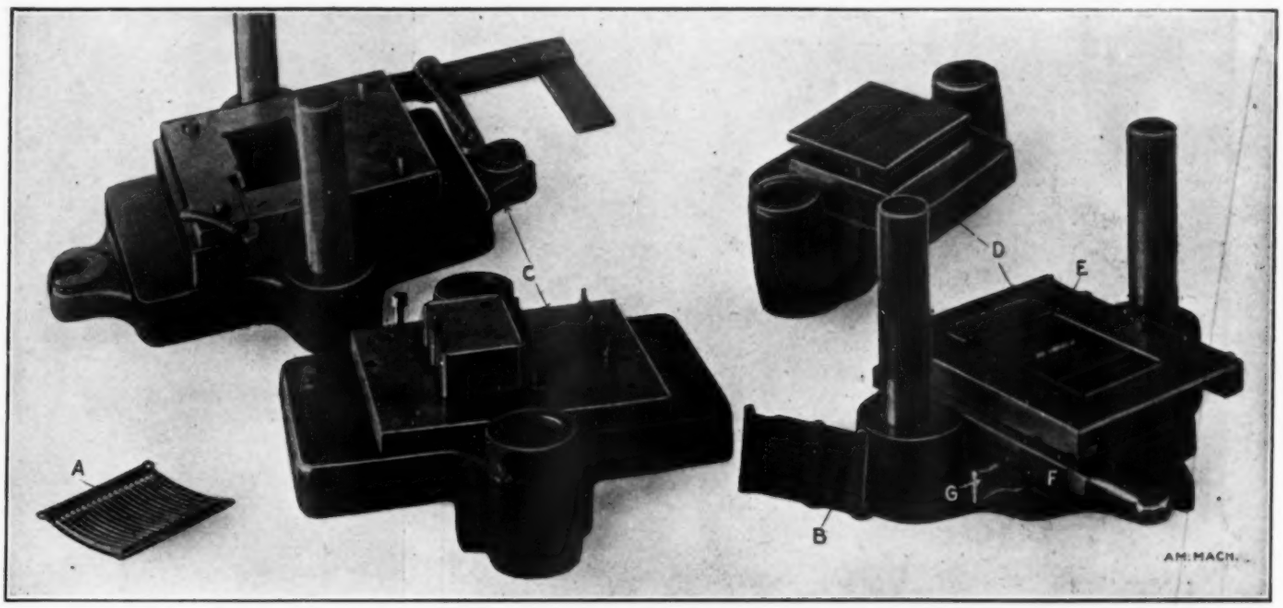


Fig. 3. Press Tools for Making Carrier for Sector Stops

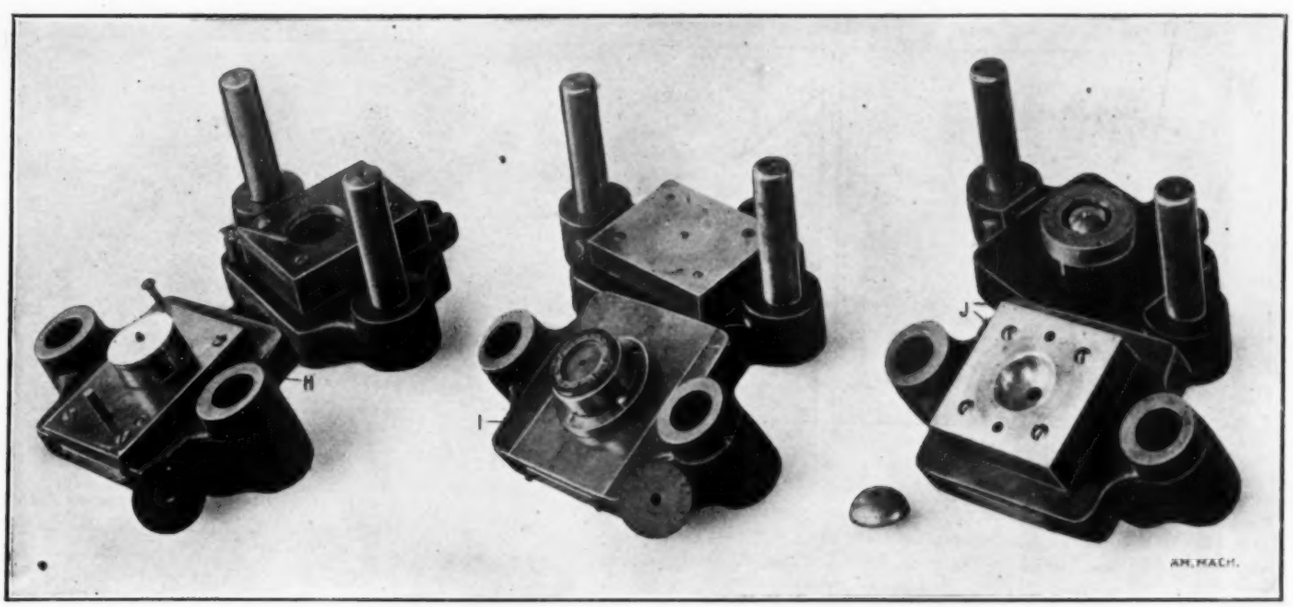


Fig. 4. Dies for Manufacturing a Graduated Bell

The models show how a single column of figures may be attended to, but it is obvious that with the eight other groups of levers, segments and type bars in place alongside the group shown, numbers with from one to nine places may be set up, printed and added into the accumulating wheels by the action of the keyboard and operating lever, in just the same way

are sure to be of interest have been selected for illustration.

The tools in Fig. 3 are for blanking and perforating the serrated plates for carrying the nine sets of sector stops (one set of which is seen at Fig. 2). These plates or carriages have 81 rectangular openings punched through them, after they have been milled across with

the form in which it comes from the perforating die, which is an indexing tool to be described later. This carrier plate is the regular size for the nine-column adder, and after it has passed through the dies shown, it only requires bending up in the forming dies to fit it for service. In use it moves endwise under the toothed sectors when the operating lever

is pulled down, and carries the nine sets of stops into position to engage the sectors, as already explained.

The Blanking and Piercing Tools

The dies for the plate, like practically all of the press tools in this shop, are of the pillar type with well proportioned guides for preserving true alignment. The blanking tools at *C* also punch the six holes for the retaining screws for the plate. These holes are punched at the first stroke of the press and the stock then advances one step and the blank is cut out. The method of guiding the stock and operating the stop will be understood from illustration.

The indexing tools at *D* are of novel construction. With these tools one row of nine rectangular holes is punched at each stroke of the press. On the upstroke the work is indexed one notch and brought into position over the die for the next row to be punched.

The plate *B*, ready for piercing, is placed on the carrier *E*, where it is located by pins over which the corner holes fit. Carrier *E* is attached to a rack *F*, which has an operating handle at the outer end and whose teeth are engaged by an indexing lever at *G* for setting the work carrier in the different positions necessary for the piercing of the successive rows of holes.

Operations are started at one end of the plate, and as the ram rises the index device is actuated and the work fed to the next position for the second row of holes to be punched, and so on across the plate. This enables a comparatively simple set of tools to be used, and these are easily kept in order without expensive repairs, also any difficulty that might arise in the simultaneous piercing of so many openings so closely spaced, is avoided. The punches are sheared back from one end and cut freely through the metal.

Tools for a Graduated Bell

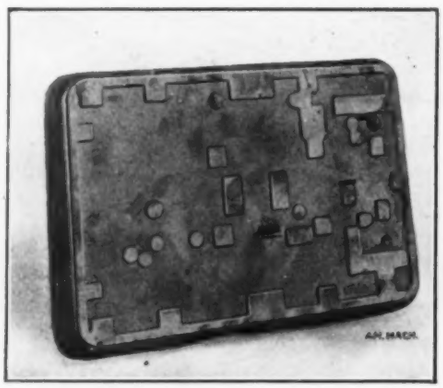
The press tools in Fig. 4 are used in the production of a graduated bell, which is pierced and blanked, graduated and formed in three operations with three sets of dies.

The first two operations are accomplished with the tools *H*, which are progressive piercing and blanking tools and require no explanation. The next operation is performed with the graduating tools *I*, the round blank being located over the pilot in the lower die, and the lines and characters stamped deeply and clearly in the metal by the punch carried by the upper number.

The forming dies are shown at *J*, and here again the work is centered by a pilot. The disk rests upon a supporting ring, which acts as a pressure pad, so that when the upper die descends, the metal is siezed between the two flat faces

Fig. 5. Vault for Press Tools

Fig. 6. A Toolroom Cabinet



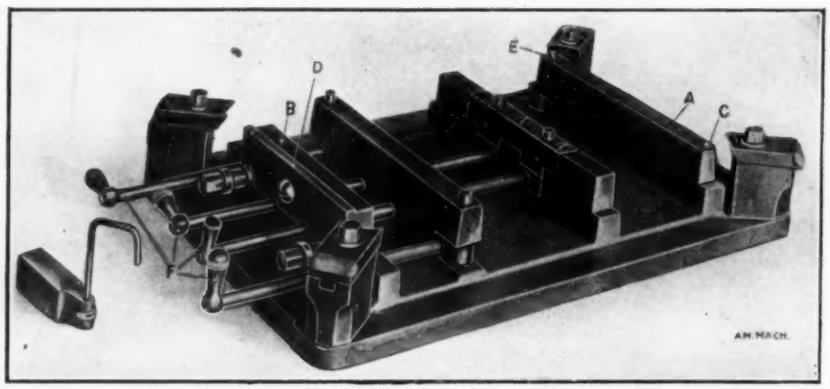


Fig. 7. Fixture for Profiling Bases

and prevented from wrinkling while being drawn down into the form of a bell.

In connection with this description of press tools, a view in the vault where such tools are stored when not in service, may be of interest. Such a view is presented in Fig. 5, which shows the vault

Toolroom Features

The equipment of the tool department consists of high-class machine tools of various kinds with the necessary appurtenances. The section devoted to storing and caring for shop tools of all sorts is fitted up with convenient cabinets, clos-

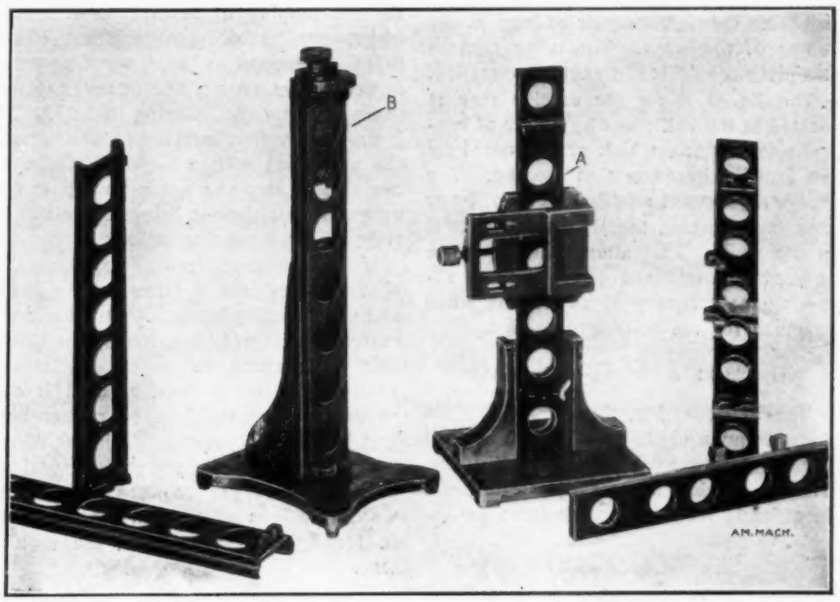


Fig. 8. Drill Jigs for Carriage Races

for about one-half its length. The general character of the tools and the systematic method of storing them so that any set may be located at once by referring to an index, is easily understood.

ets, etc., for keeping the tools in proper order, where they are out of the way and where they may be found the moment they are required in service.

A view of a small portion of a row of cabinets along the wall of the toolroom is shown in Fig. 6. The first stack of drawers is devoted to the storage of small jigs and fixtures, and two of the drawers are partially withdrawn in this view to show the nature of the contents. Several illustrations are shown, representing tools which are used for various purposes, but which were not in operation at the time the photographs were taken.

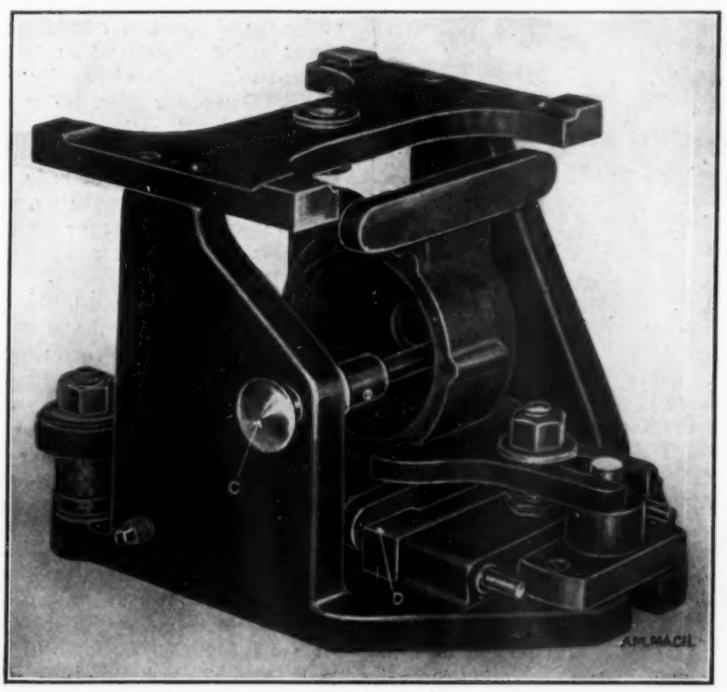


Fig. 9. Jig for Drilling Shaft Hole

Profiler Fixtures for Bases

The fixture in Fig. 7 is used on the profiler for holding adding-machine bases

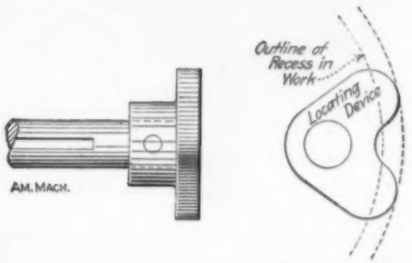


Fig. 10. Locating Plug for Wormwheel Casing

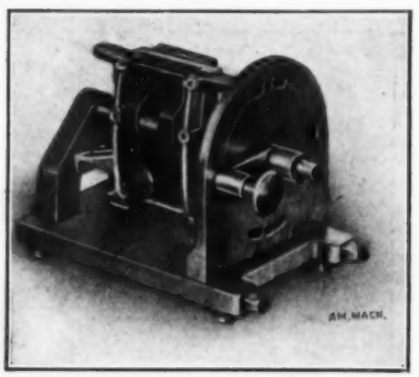


Fig. 11. An Indexing Jig

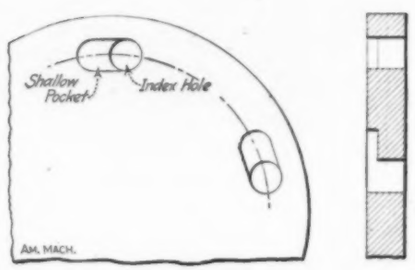


Fig. 12. Index Plate

while the upper face, with its numerous bosses, is being finished. In setting the base on the fixture, provision is made for leveling it by the top surface, so that the cutter will have a fairly uniform amount of metal to remove at all points. The hollow casting is placed over the blocks *A* and *B*, and rests upon fixed support *C*, and upon a swiveling jaw *D*, mounted upon the face of the block *B*.

The rocker *D* adjusts itself to the interior of the work, and the fourth sup-

port *E*, at the left end of the block *A*, is adjusted by a knurled nut near the bottom until it contacts with the work. This support and the rocker *D* allow the casting to be set level, as tested by the hooked height gage, which is applied at the four

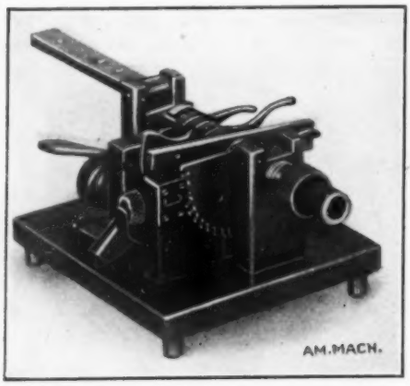


FIG. 13. AN ASSEMBLING AND PINNING JIG

corners, and the swiveling support may then be clamped.

In addition to these supports under the ends there are four spring pins near the center, which are allowed to lift into contact with the work, and are clamped by the binders controlled by handles *F*. These central supports, of course, are not brought into service until the work has been secured by the four corner clamps, which are beveled at their inner ends to conform to the slope of the casting.

JIGS FOR CARRIAGE BALL RACES

Two jigs are illustrated in Fig. 8 for drilling small holes in the lugs of outer and inner ball races for carriages. In both cases the jigs locate from the finished race, and the work itself is held upright by guides on the jig bases, which fit the finished V's in the work.

The jig proper for the inner race *A* resembles a clamp in appearance, as it is made up of a fixed jaw, which enters one side of the work while the opposite jaw is closed by a screw to keep the device in position. This jig has two bushings only, which guide the drills that put the holes through the pair of lugs at the center of the work. The other lugs in this piece are drilled in another operation.

The jig at *B* for the outside race is located in the ball races by a pair of centralizing wedges, which are adjusted by the knurled headscrew at the top. The wedge adjustment acts like a pair of taper gibs for clamping the jig exactly central in the work. This allows the jig to be entered and removed easily without affecting the accuracy of its location when in place for the drilling operation.

DRILLING A WORM-GEAR CASE

The halftone, Fig. 9, represents a jig for drilling a shaft hole in a case used for a worm-gear drive for a small motor. The casting has a recessed interior, and in order to locate the work from the re-

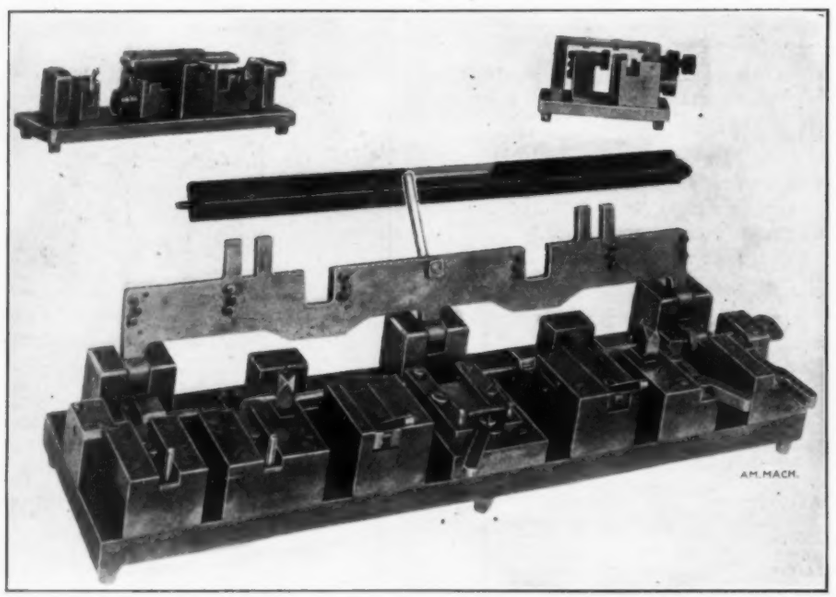


FIG. 14. ASSEMBLING JIGS

cess, a plug with a forked end is fitted in a sleeve in the jig wall at *C*, the inner end of the device having the form indicated in Fig. 10. This plug is drawn back for the admission of the casting, then it is slid to the right, with its forked ends in contact with the inner wall of the chamber. A groove and pin locate the plug, so that the forked end is kept central with the horizontal plane, as shown by the sketch.

The base of the casting to be drilled is pressed against a spring-controlled parallel at *D*. The action of this parallel is to hold the work against the locating device and at the same time position the work square in the jig, so that when the clamps are tightened at front and rear, the piece is ready for drilling.

AN INDEXING JIG

The jig in Fig. 11 is used for holding a die-cast frame in a number of positions for the tapping of several small holes, which are at different angles. These holes are formed in the die-cast process, at the proper angles, and in order to tap them correctly the indexing jig in Fig. 11 is provided with a carrying fixture to hold the work and with a series of holes at the side to stop the crank handle at the necessary positions to bring the holes upright under a tapping spindle.

It will be seen from Fig. 12 that a shallow elongation is formed at the outer end of the index holes. When the index crank is revolved, the index pin drops into the opening and stops against the back of the index hole, so that it can never run past the hole no matter how fast it may be operated. This facilitates the setting of the work to the various positions, and the castings are tapped with little loss of time in placing them in the jig and indexing in the regular way.

ASSEMBLING JIGS

A good many assembling jigs are used at this plant, and a few are illustrated by Figs. 13 and 14. The first is a jig for drilling and pinning the escapement mechanism. All parts in the unit are assembled and held in proper relation to one another in the jig, while the pin holes are put through hubs and shaft.

Two small assembling jigs are shown at the top of Fig. 14 for handling certain shafts and the parts which they carry. In the foreground is a larger jig for paper tables. One of the paper tables is shown directly above the jig. It carries four small lugs or brackets, through which a steel shaft is passed. The body, brackets and shaft are placed in the jig, the holes drilled through all parts for the pins, and the pins or rivets inserted before the work is removed.

The work, when placed in the jig, rests with the steel rod in the V-blocks and with the brackets, held centrally by guiding devices, the clamps for the different parts being operated quickly, and the jig when closed held shut by a pair of buttons. The jig is made to take work of different lengths.

Germany's exports of machinery underwent a big increase last year. The total was 539,341 tons, valued at $141,000,000, compared with 452,732 tons, valued at $119,200,000 for 1910. Imports were also somewhat heavier than for 1911, having amounted to 78,000 tons, against 71,000 tons in 1910.

Heavy Driller in Automobile Work

Special Correspondence

Methods and tools used in machining automobile cylinders and brake support forgings on modern high-powered drillers.

Those who are familiar with the shops building automobiles have noticed the growing tendency to use the modern driller on more and more varieties of work, instead of having special machines for each operation. While this is in opposition to the idea of the single-purpose machine, it has the advantage of making a more flexible equipment, which can be changed from one type of work to another, if it becomes necessary to increase the output of a particular piece or group of pieces. This makes it more easily possible to keep the production of the various parts on a more even basis and to prevent over-production of one part and shortage on others.

While this would not be the case with a perfect balancing of machines against production, it makes the selection of the equipment a much easier problem, and may prevent delay which could easily occur under the other plan. Only the advent of the modern high-power driller has made such an arrangement possible, and the following illustrations will show the methods and equipment which are being used in two modern shops.

Machining Rear-axle Brake Supports

The equipment shown in Figs. 1, 2 and 3 shows the method of machining automobile rear-axle brake-support forging, Fig. 1 showing the first setting in which the hub is first bored out with a $1\frac{7}{8}$-in. drill, faced on the end and the whole then rough and finish reamed, with taper reamers having pilots fitted in the hardened bushing shown beneath the forging. The roughing reamer, having nicked teeth, is shown in place, the finishing reamer being made with spiral flutes and solid cutting edges. The large diameter of the tapered hole is $2\frac{7}{16}$ in.

The second setting of the machine is shown in Fig. 2, where the two small bosses on the end of the forging, which connect to the brake band, are drilled, reamed, counterbored and faced, and the outside of one hub is turned. The holes drilled are one inch in diameter.

Fig. 1. Rough Reaming Brake Forging

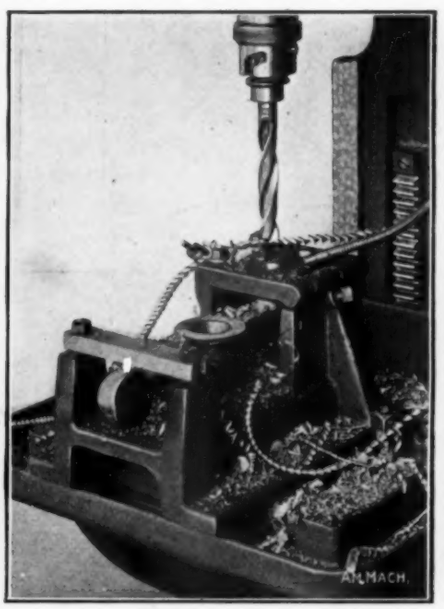


Fig. 2. Drilling the End Hole

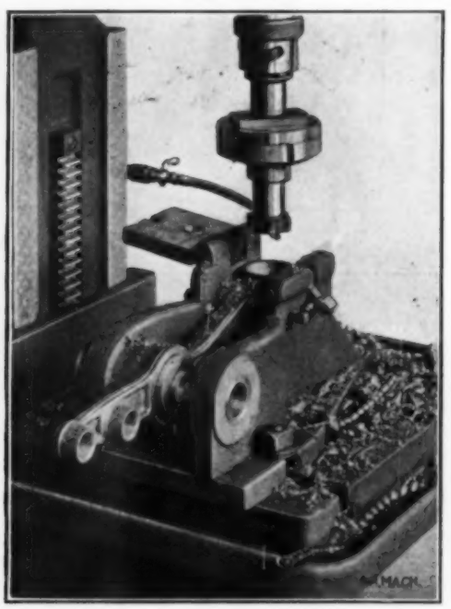


Fig. 3. Tapping Ball and Socket Joint

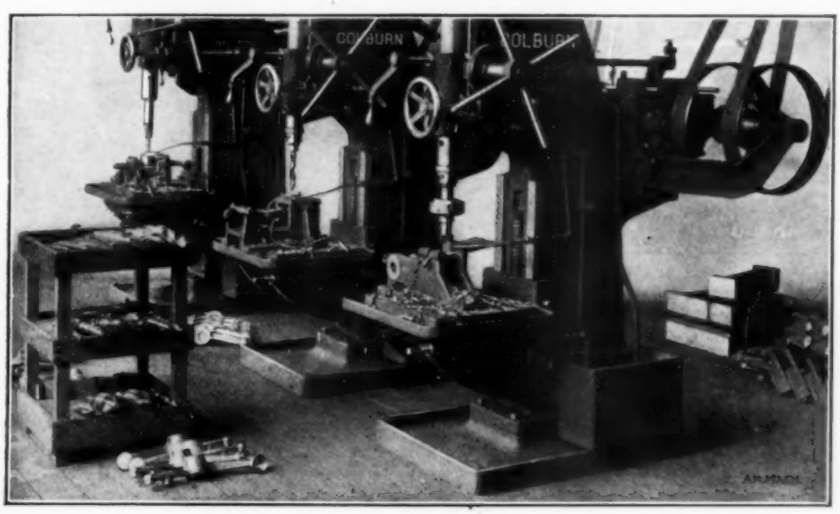


Fig. 4. The Group of Drillers

Going to Fig. 3, which is the third setting for this particular job, we find the ball seat in the large boss is drilled, counterbored out to fit the ball and tapped. The tap is $2\frac{3}{8}$ in. in diameter and has 16 threads per inch, being held in a safety tap holder, which slips when the tap bottoms in the hole. A tapping device reverses the spindle motion at the proper time.

The group of machines shown in Fig. 4 is the complete equipment for handling this work, the arrangement being such as to make it convenient to handle the work from one machine to the other. As will be seen, the machine at the right is

equipped with double pulleys, which provide proper drilling and tapping speeds. The tools used are very conveniently held on the tool stand, shown at the left, all convenience of this kind serving, not only to protect the tools themselves, but also to make it easier for the men, and thereby increase the output.

The Tools Used

The tools used by this group of machines are shown in Fig. 5, with the exception of the plain drills. Included are the roughing and finishing taper reamers, 1 and 2, the facing tools, 3, 4 and 5, and the outside turning tool for the boss in Fig. 6. Nos. 7 and 8 are for forming the ball seat, already referred to, while No. 9 is the tap complete in the friction holder. Nos. 10 and 11 show the construction of the quick-releasing chuck, all tools from 4 to 9, inclusive, being equipped for this. No. 12 is simply a plain countersinking reamer.

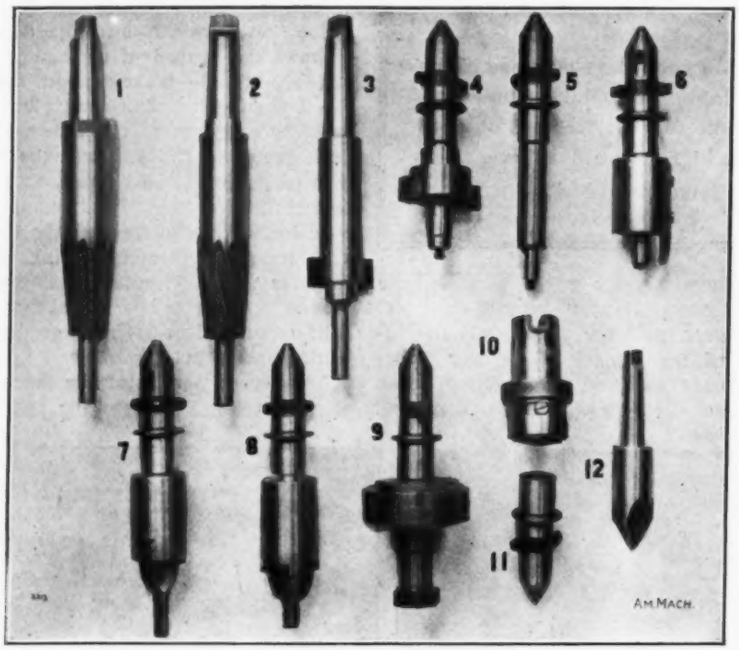


Fig. 5. The Tools Used

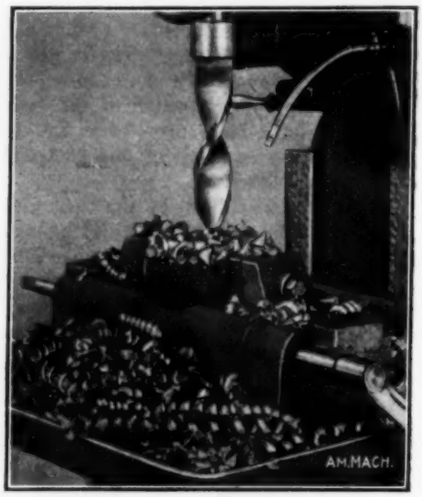


Fig. 6. Drilling Large Gear Blanks

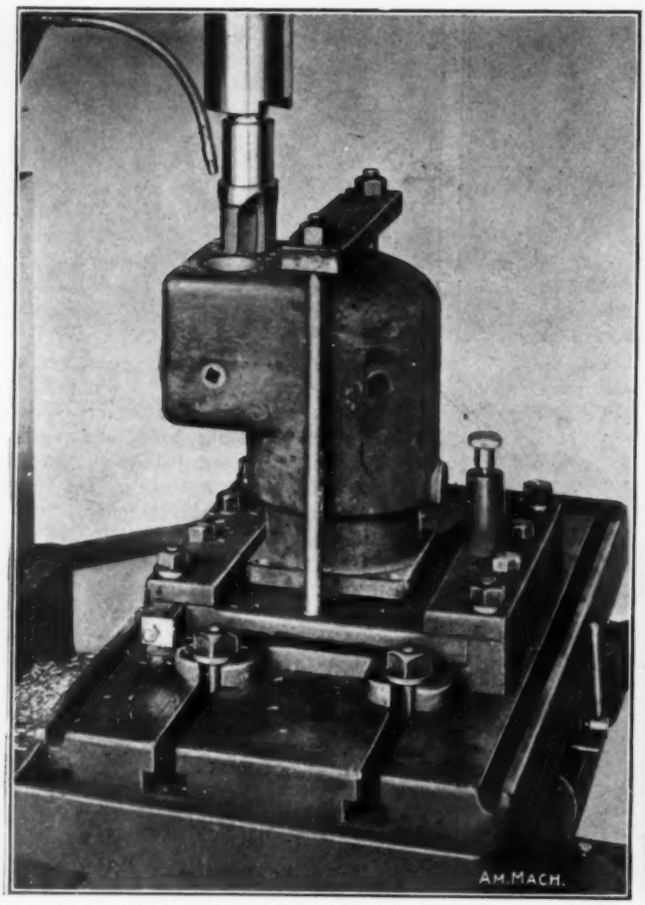


Fig. 7. Machining the Valve Chamber

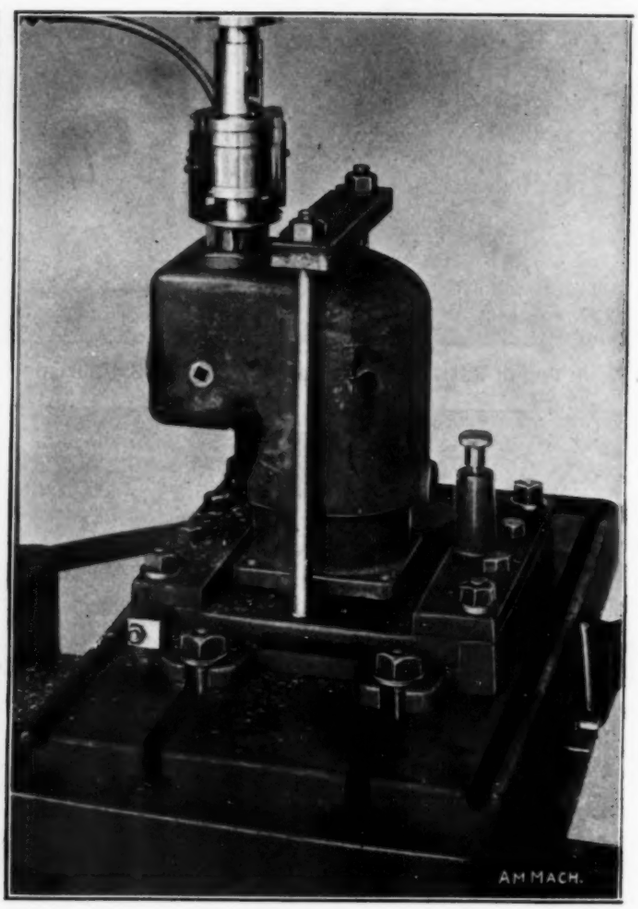


Fig. 8. Tapping Valve Chamber

In Fig. 6 the machine is simply equipped with a substantial two-jawed chuck and is used for boring the holes in gear blanks, and similar work. As equipped, it will hold work up to 12 in. in diameter. As shown, a 2½-in., high-speed twisted drill is being driven, with a feed of 4 in. per minute.

The Cylinder-boring Equipment

Another group of machines is equipped with fixtures for machining the cylinders. Fig. 7 shows one of the valve openings being bored, the cylinder having been moved to its present position by means of the slide which holds the cylinder and moves in the base, which is substantially bolted to the driller table. A taper gib takes up all wear and insures the accuracy of the slide movement, while the index pin shown, locates the cylinder in either one position or the other.

In Fig. 8 the same hole is being tapped with a Geometric collapsing tap, which insures the thread being concentric with the holes and the valve seat, both boring and tapping being done before releasing the cylinder from the fixture.

The next operation is boring the cylinders, which are held in the fixtute shown in Fig. 9. The substantial boring cutter shown is used for this work, a somewhat similar cutter being used for finishing, as can be seen in Fig. 12. There is no indicating necessary in this case, as the cylinders are of the single-unit type, instead of being cast *enbloc*.

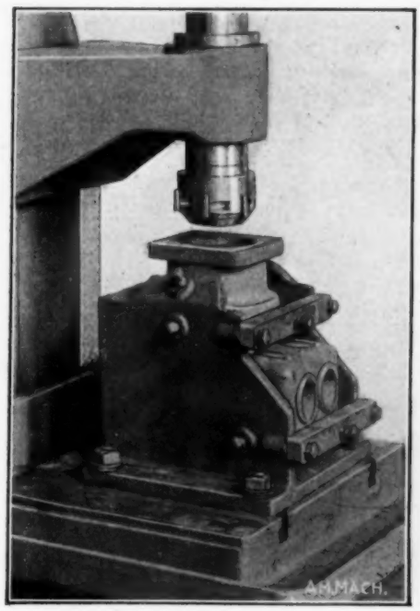


Fig. 9. Boring the Cylinder

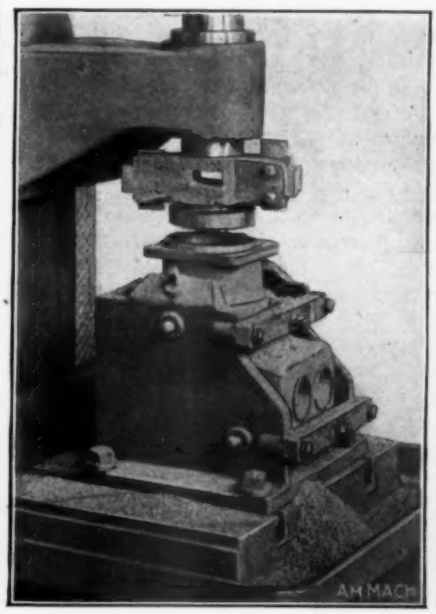


Fig. 10. Facing Cylinder Flange

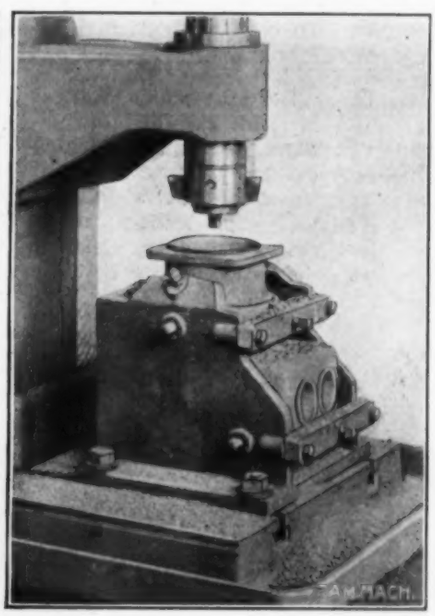


Fig. 11. Chamfering Cylinder Bore

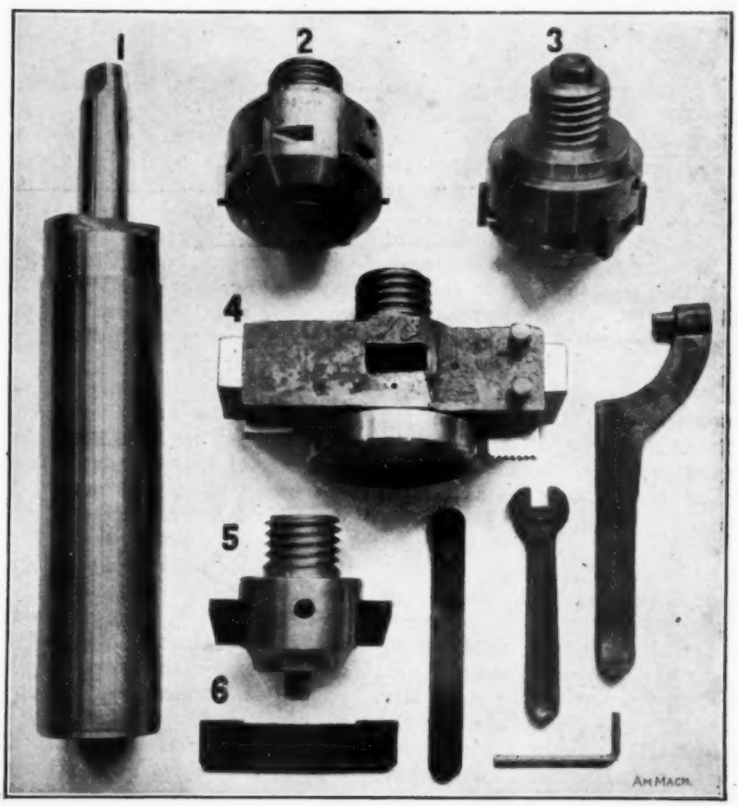


Fig. 12. Tools for the Cylinder

The cylinders are squared on the bottom, and the flange turned down to leave the projecting ring or spigot by the sweep tool shown. Details of this can be seen at No. 4 in Fig. 12, wherein it will be seen that the roughing cutter has a serrated edge for breaking up the scale. The finishing cutter has a plain surface for leaving the flange smooth and square. The large pilot fits the cylinder bore and insures the projection being concentric and the flange face perfectly square.

Boring Tools and Supports

The counterboring or chamfering tool is shown in Fig. 11. The construction of the boring tools can be seen from Nos. 2 and 3, there being 6 inserted teeth, which are adjustable for size by drawing in the central expanding cone and then locking each cutter by its individual clamping screw. The body of the sweep or facing tool is a steel casting, the cutters being held by the setscrews shown. The construction of the chamfering and facing cutters is shown in Figs. 5 and 6; the rest of the equipment being wrenches for adjusting the different tools shown.

All the tools with the threaded shanks screw into the bar shown in No. 1. This

fits the taper of the spindle and drives the tools at sufficient distance from the end of the spindle to reach the bottom of the cylinder. It also affords a means of steadying the tools as near the work as possible by having the large diameter of the bar supported by the substantial steady rest, which can be fastened to the face of the column.

The drillers shown are made by the Colburn Machine Tool Co., Franklin, Penn.

Welding a Crankshaft

By L. H. Burkhart

The illustrations show the method that was employed at the shop of Struthers-Wells Co., Warren, Penn., for repairing a broken crankshaft.

The shaft is of cast steel and is in a 6x6-in. Triplex pump. During a recent cold spell it was started up while the cylinders were frozen. The shaft broke near the web *A*, Fig. 1.

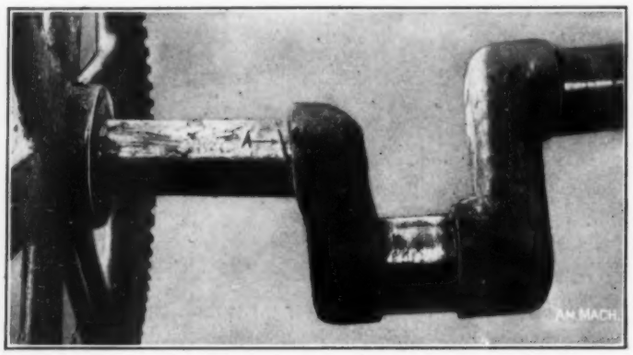


Fig. 1. Showing Break in Shaft

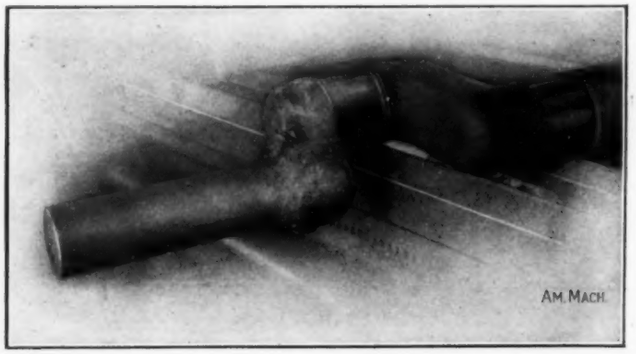


Fig. 3. Shaft After Welding

The shaft was prepared for welding as shown in Fig. 2. A ¾-in. hole was drilled through the web and countersunk on both sides; this space was filled in with weld-

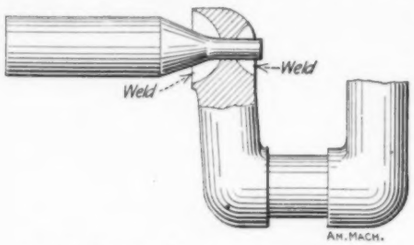


Fig. 2. Shaft Prepared for Welding

ing material by the oxyacetylene process. The new part of the shaft was made ¼ in. larger in diameter than the finished size. Fig. 3 hows the shaft after it had been welded, but before the welded portion had been turned down. The shaft appeared stronger after repairing than before.

Cause and Effect

The superintendent of motive power was busily engaged in explaining a detail of the shop organization as we stepped through the doorway leading to the machine and erecting shop, states a writer in the *American Engineer*. Our quiet entrance into the noisy shop undoubtedly attracted little, if any, attention, until we had advanced some ten feet or more into it. At that time, however, things in our end of the big shop seemed to move a little more lively, and the workmen began to work at a faster pace, at least so it seemed from the actions of some of them and the increased noise and din of the shop. Above the noise, however, could be heard a series of low, but penetrating whistles, which seemed to travel down along the shop, and were apparently signals announcing the approach of one in authority. A visitor does not like to be discourteous enough to notice such things, so I appeared to be busily engaged in examining the finish on a crankpin in one of the driving wheels. However, glancing out of the corner of my eye, I could see a slight flush gradually extending over the face of the superintendent of motive power.

In chatting in his office later in the day I asked permission to take some photographs in the tin shop and to describe the methods which were in use in that shop. The foreman seemed to be a good executive, and, with one of his assistants, had contrived some very ingenious devices, which greatly facilitated the work and reduced the cost of production.

"No!" said the superintendent of motive power, "you cannot do it."

"That seems strange," I said, "for you have such a splendid department, and the man in charge is much more capable than the average man holding the same position."

"That is just why I don't want to have you describe it."

Almost unconsciously I gasped out, "Why?"

"Because, if you were to publish a description of John's work he would get the big head and would want more money. He would become dissatisfied or else someone would come in and offer him more money, and we would either have to raise his salary or lose him."

The scene shifts to another shop of about the same size as the one in which the above mentioned incident took place. As I entered a large door at the end of the machine and erecting shop, I was immediately impressed with the fact that the work seemed to be carried on at a good lively pace. I was unaccompanied by any of the mechanical-department officials, and the men seemed to pay no attention to my presence. Every department in the large plant seemed to be operated to its full capacity. There was no confusion on the part of the workmen and no loafing was apparent. I learned afterward that the output of the shop was surprisingly large, considering its size.

The Respective Results Reflected in the Two Attitudes

Naturally I was interested in meeting and studying the shop superintendent in charge, since the whole attitude of the men was so entirely different from the shop which I previously visited. One of the first things that he said when I met him was:

"If you have your camera with you, be sure and make good use of it in our blacksmith shop. The foreman and his assistant are doing splendid work, and you will not only secure a splendid article for your readers, but our foremen will be inspired to greater efforts when they see that their work is appreciated, not only by those of us to whom they report, but by the railways at large."

The shop superintendent then drew attention to some of the more important things which were being accomplished in a number of the other departments, and gave much active assistance in helping to get his foremen interested in furnishing all the details about the way in which the various classes of work were being handled.

The contrast between the two shops was so great that it prompted investigation into the comparative output. It was found that the second shop turned out considerably more work with a much smaller number of men. How is your shop or department being managed, and are you cultivating or killing the best efforts of the men under you?

The Machining of Railway Motors—II

By C. B. Auel*

Some of the more important mechanical features involved in the manufacture of these. Details of the machining operations on the armature cores, housings, poles, bearings, etc.

Armature Core

Boring the Spider—Armature spiders are almost invariably made of malleable iron or cast steel. The end bell is a solid part of the spider itself, and the casting is hollowed out or grooved longitudinally. This grooving serves the double function of reducing the weight of material, as well as forming a part of the system of ventilation required by every motor. Fig. 8 shows a machined spider, on which have been placed the laminated punchings. A good view is here obtained of the radial ventilation ducts. In the machining of a spider, the first operation is that of boring for the armature shaft. This is done on special lathes, one type of which is illustrated by Fig. 9.

Two roughing cuts and one finishing cut are taken. In case the spider is of malleable iron, it is then reamed for a finish; if, however, it is of cast steel, a floating cutter is put through instead of the reamer. All bores must be finished within 0.0005 in. of the dimension specified, the allowance for press fit of the armature shaft being made in the shaft itself. While reamers give a little smoother finish to the bore, they cannot be used to the same advantage on cast steel as on malleable iron, the cuttings having a tendency to clog the reamers.

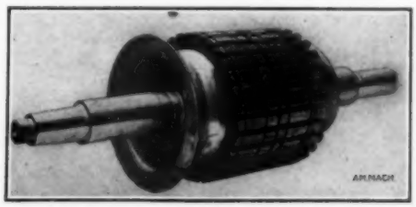


Fig. 8. A Partly Completed Armature

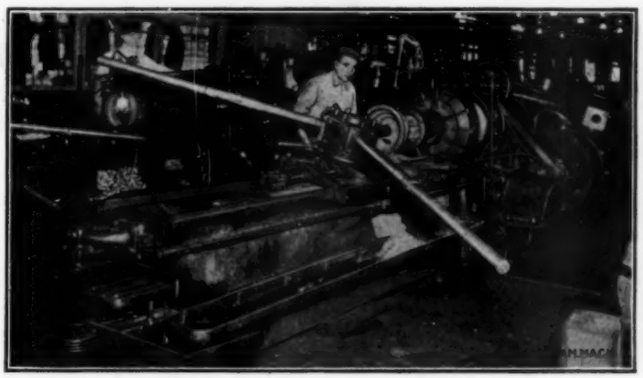


Fig. 9. One of the Special Lathes

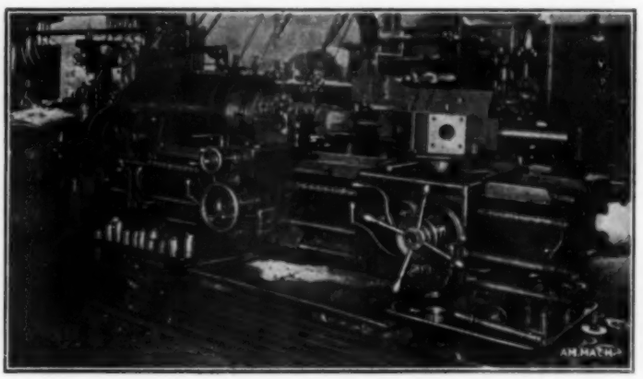


Fig. 10. The Second Lathe Operation

Turning the Spider—After the spider has been bored, and while still in the same lathe, the rear or end bell part is turned and faced. The spider is then removed; a mandrel is pressed into it; it is then placed in another special lathe, Fig. 10, and the remaining portion is turned to within $\frac{1}{32}$ in. of finished size, this amount being allowed for subsequent grinding.

Cutting Keyways in the Spider—There are three keyways cut in each spider, two of these being on the outside in direct line with each other, and one on the inside. The two on the outside are for the commutator and the sheet-steel laminations, respectively, while the keyway on the inside holds the shaft when it is eventually pressed into the spider. The methods of cutting each of these keyways are clearly shown by Figs. 11 and 12. In the former, a vertical miller cuts both keyways at one setting, while in the latter a key-seater is used. Keyways are made 0.002 in. under size, so that the keys require to be driven into position, and will accordingly be a so called driving fit.

Grinding the Spider—All spiders, whether of malleable iron or of steel, are now ground to finished size, Fig. 13, instead of being finish turned, as was formerly the practice. In order that the laminations will fit tightly, when pressed into position on the spider and will continue so after the motor has been in service, the finished diameter of the spider is made 0.002 in. larger than the bore of the laminations. Besides seeing that this dimension is maintained within 0.0005 in. either way, the utmost care is also taken to keep the punching dies sharp and right up to proper diameter, and not allow them to become worn, thus increasing the size of the bore as well as producing burred laminations.

Building of the Armature Core—With the object of having the laminated punchings, as just mentioned, a very tight fit on the spider, when building up the armature core, a certain quantity of them is weighed out, the proper amount having been determined at the time of building the first or experimental motor of each type and size. A few of these punchings are then put on the spider and driven home, by means of a hydraulic press, Fig. 14. When finally all of the weighed punchings are thus placed in position, the end plate is put on, proper pressure is applied and the armature-ring nut is screwed down tightly. The length of the laminations is measured, preparatory to the screwing down of the nut, to see that it checks with the dimension specified, sheets being added or subtracted, if necessary, to make it do so.

As with the weighing of the punchings, the pressure to be applied in forcing them together is determined from the first motor, varying from 40 to 60 tons, depending upon the type and size of the armature. Due to the precautions cited, practically all filing of the built-up core has been eliminated.

Cutting Off and Centering the Armature Shaft—The bar stock of axle steel is first cut off to within $\frac{1}{32}$ in. of finished length, then centered. Special attention has been given to this latter operation, and not only is the shaft drilled somewhat deeper than the apex of the 60-deg. centering angle, but it is also counterbored at the base of this angle. By these two features, any bluntness or damage to the point of the lathe center or any blow given to the cutoff stock on its end, in no wise affects the proper centering of the stock in subsequent lathe operations.

Rough Turning and Spotting of the Shaft—The stock is rough turned to about 0.020 in. of the finished size, being rough tapered on one end for the pinion.

It is then spotted for grinding, and at the same time threaded for the pinion nut. The spotting of a shaft consists in turning it down exactly to finished size through a small width, $\frac{1}{16}$ in. or slightly more, at every point where its diameter changes. In so doing, the grinders are provided with a set of guides to which they work in the operation of grinding the shafts.

Cutting Keyways in the Shaft—Two keyways are milled in the shaft for the spider and the pinion, respectively, these being done very much after the manner of cutting the two external keyways in the spider, already described.

Grinding the Shaft—In the final operations on the shaft as a separate item, grinding has been adopted as a standard, in preference to finish turning, both for the body and for the tapered portion. It is not claimed that grinding is any cheaper, but it is firmly believed to give a better quality of work and the number of "defectives," due to finishing shafts under size, is certainly lessened. In general, these operations are much like the grinding of the spiders, mentioned in a previous paragraph.

Miscellaneous Operations—With the finishing of the shaft and the building up of the armature core, the two are now ready to be put together. The operation of doing this is shown in Fig 15. The pressure employed will, as with the pressing of the laminations on the spider, vary with the type and size of motor, running from 15 or 20 tons in a small motor, to 60 or more tons in the larger sizes.

When the shaft is being forced into position, there is a marked tendency for it to push the walls of the spider outward, thus causing them to bite into the encircling laminations and produce an exceedingly tight grip between the two. The completed armature core is now placed in a lathe to observe if it runs true, after which it is balanced, as shown in Fig. 16. Balancing, when necessary, is done by pouring solder into various pockets provided in the spider for this purpose, access to these being had by means of one or more small holes, which must be drilled with the aid of a breast drill.

Housings

Boring and Turning—By housings is meant the castings serving as supports for the armature bearings, which in turn support the armature when in position in the field of the motor. Housings may be either of malleable iron or cast steel. In machining they are rough bored, faced and turned at a single setting, as shown on the vertical boring mill in Fig. 17, a variation of but 0.0015 in. being permitted either way from the given dimensions.

As was mentioned under the paragraph on "Field Bore," it is necessary in all railway motors to make provision for wear in the armature bearings, for which purpose the armature is elevated $\frac{1}{32}$ in. above the true center. This may be accomplished either by boring the field $\frac{1}{32}$ in. below center, thus bringing the armature that much nearer to the upper field poles and in so doing giving the armature bearings an additional wearing distance of this amount in a downward direction; or, the field may be bored true to center and the offset made in the housings themselves. In this latter case, the housing after being bored, faced and turned is shifted 0.015 in. off center in a direction which would be downward were it occupying the right position in the motor. It is then finish bored to within 0.0005 in. of the specified size.

Miscellaneous Operations—The housings must now be drilled and tapped for the bolts which are to hold it to the motor, and the keyway must also be cut for the armature bearings. As each housing contains a pocket or well for the supply of oil to the bearings and is likely to have foundry sand adhering to it, each casting is boiled in a strong solution of lye for a half hour or more. It is, after

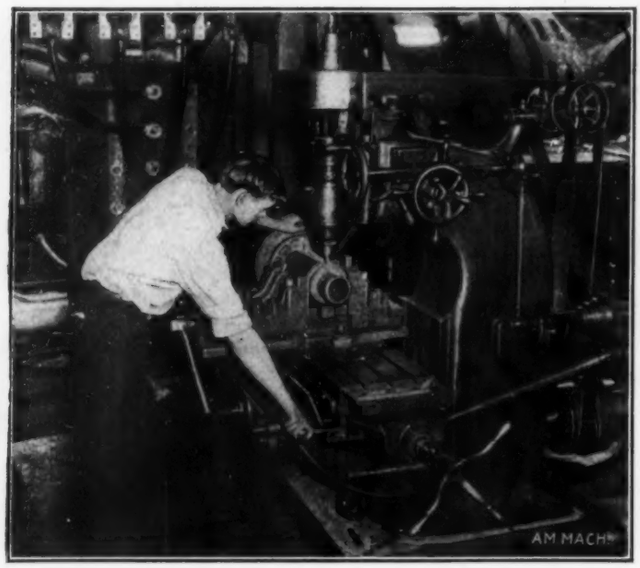


Fig. 11. A Vertical Miller Cuts Both Keyways at One Setting

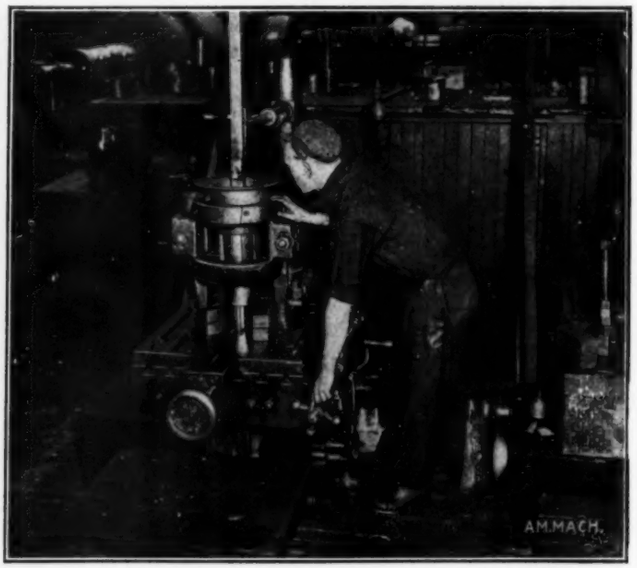


Fig. 12. The Keyseater Cutting the Inside Keyway

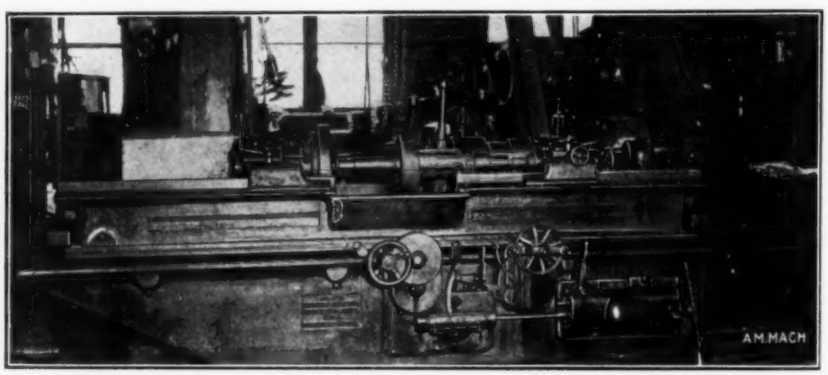


Fig. 13. Grinding the Spider

drying, cleaned with a strong air blast and is then tested for leaks with kerosene oil in the same manner as the axle caps. The hole for the oilbox cover hinge is finally drilled, the cover fitted and the armature bearing pressed into it, as shown in Fig. 18, a pressure of 3 to 5 tons being used.

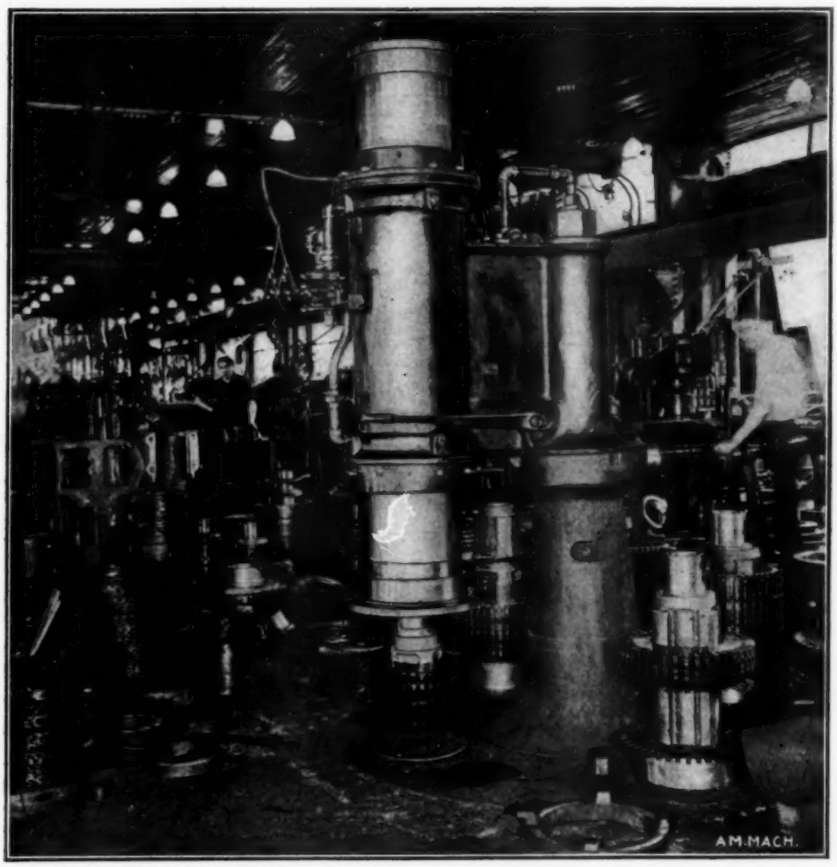


FIG. 14. PRESSING ON THE LAMINATIONS

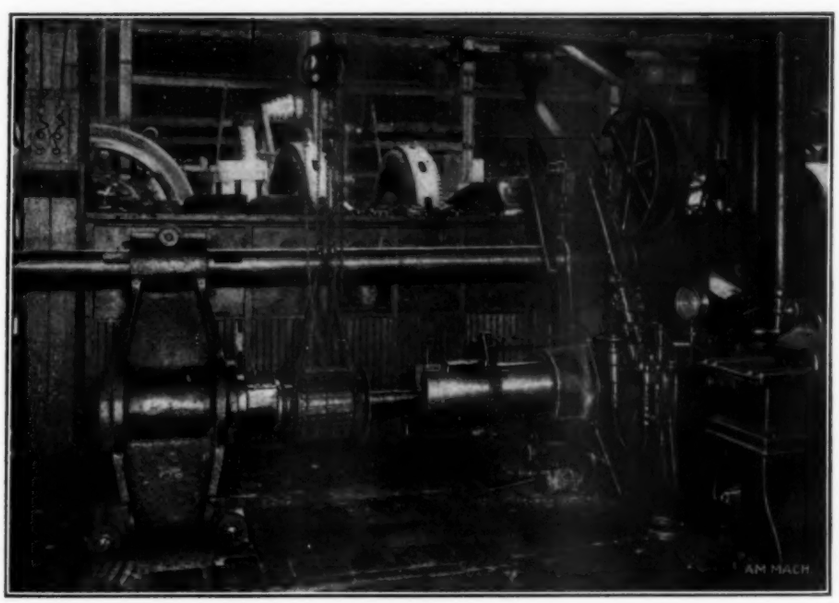


FIG. 15. PUTTING THE SHAFT AND CORE TOGETHER

POLES

How the Poles Are Made—The field poles consist of laminated punchings built up between two end plates, held together by rivets and supported against the inside of the field castings by bolts while projecting radially toward the armature. They are usually four in number, except in interpole motors, where there are four auxiliary poles, though these latter are rather different in construction. The end plates, which may be of wrought iron, malleable iron or drop forgings, have the necessary rivet holes either drilled or punched in them, after which the holes are countersunk. The end plates are next ground to remove any burrs or fins, as well as to round the edges.

In building a pole, the rivets are first placed in one of the end plates, then a certain amount of the laminated punchings is weighed, the quantity, as in the case of the armature laminations, being determined from the experimental motor of each type and size; a few of the punchings at a time are placed over the rivets until all are in position. In some types of motors, the punchings are not symmetrical, and in such instances they require to be put on, one at a time, alternate ones being reversed in so doing. About 60 tons pressure is then applied, and the length of iron is measured to ascertain if it is in accord with the dimension specified, sheets being added or subtracted, the same as in building up the armature core, to make it do so.

The pole is clamped while under pressure, the pressure then released, and a double nut is pressed into a hole in the punchings. The ends of the projecting rivets are next flanged out under a press until they completely fill the countersunk hole in the end plate. The pole is next squared, ground along the edges and at the corners and hand filed as well, if necessary. The studs which hold the pole to the field, are now screwed into the double nut, and the pole is then considered finished.

CARBON HOLDERS

Construction of Holders—A good carbon holder is the result of years of careful study of details of design, including workmanship and materials, and of subsequent operation under service conditions. It must transmit the current without abnormal heating; it must have a practically uniform tension throughout the working range of the carbon; it must not occupy an undue amount of space and it must be durable over a considerable number of years.

In Fig. 19 is shown one such type of holder. As will be seen, it consists of a compact brass casting, carefully machined, into which are inserted two parallel steel pins, held firmly by dowels. Over these pins, closely fitting tubes of insulation are placed, while over these in turn are thin brass shells and porcelains. The holder, when in position, is gripped between a machined projection on the motor and a malleable-iron clamp, and it is the function of the brass shells to prevent damage to the insulating tubes. The porcelains serve to space and to insulate the holder proper, the correct distance

from the clamp. They are corrugated to add to the creeping distance, thus rendering more remote the possibility of grounding from the holder to the brass shells or to the clamp.

The spring device is simple and self-contained. It consists of a brass punching, on which is supported a helical spring of phosphor-bronze strap, to the end of which spring, adjacent to the carbon, is attached a copper tip and a flexible copper shunt. The other end of the spring is secured to a pawl and sprocket, by means of which the upper tension on the carbon may be obtained. The tip and the shunt are insulated from the phosphor-bronze spring, thus keeping the current away from it and preventing it from becoming overheated, with consequent change in temper. The tension of the spring is adjusted for each type of motor, varying usually between the limits of 4 and 6 lb.

The carbon slots are tested for accuracy by means of plug gages, a variation of 0.002 in. being permissible; the carbons themselves are tested by maximum and minimum limit gages, while the tension of the spring is adjusted by a scale. The distance between the centers of the steel pins and the centers of the carbon slots is carefully checked, also the position of the pins with reference to parallelism with the slots.

Commutator

Important Commutator Details—There are several important detailed requirements which must be fulfilled by every commutator if it is to give satisfactory service. Among these may be mentioned, rigidity of construction, maximum wearing depth of commutator bar, sparkless operation, freedom from short circuits, grounds, etc. The making of a commutator, such as that shown in Fig. 20, may be divided into three steps: Machining of bush and V-ring, which may be either of cast steel, malleable iron or forgings, building up of copper bars, and assembling of the commutator.

The bar copper from which the bars are punched is required to be within 0.001 in. either way of the specified thickness. Experience has shown that far better results will be obtained, if, in the punching of the bars, finish is allowed for in the Vs, so that the bars may be machined to size subsequently. The mica segments used for insulating the commutator bars from one another, are allowed to vary but 0.0015 in. in excess of the specified thickness; if under size they are rejected.

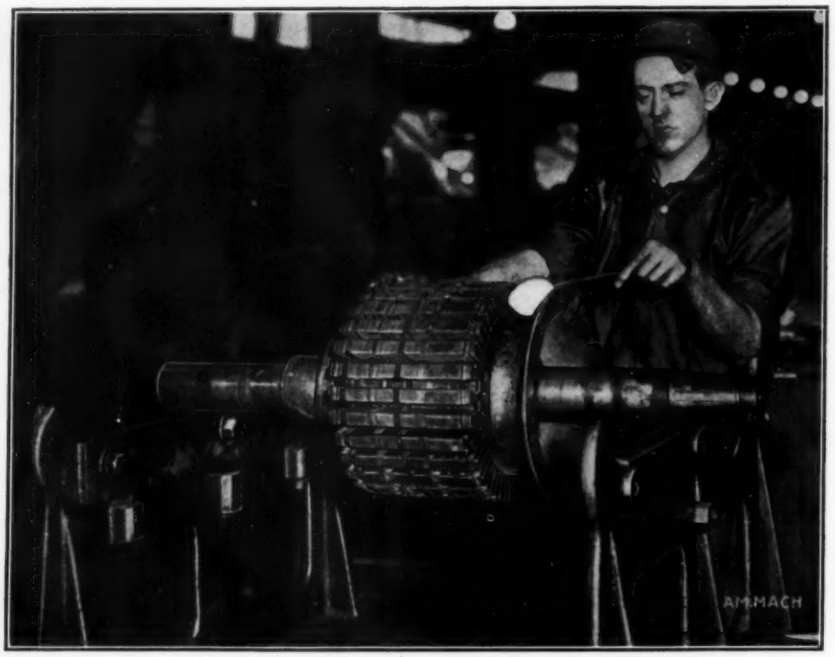


Fig. 16. Balancing the Completed Armature Core

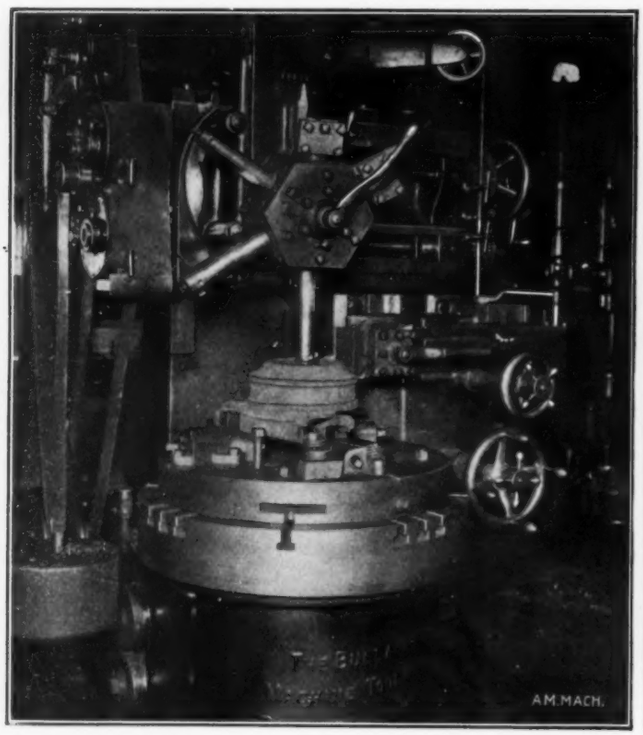


Fig. 17. Rough Boring, Facing and Turning at a Single Setting

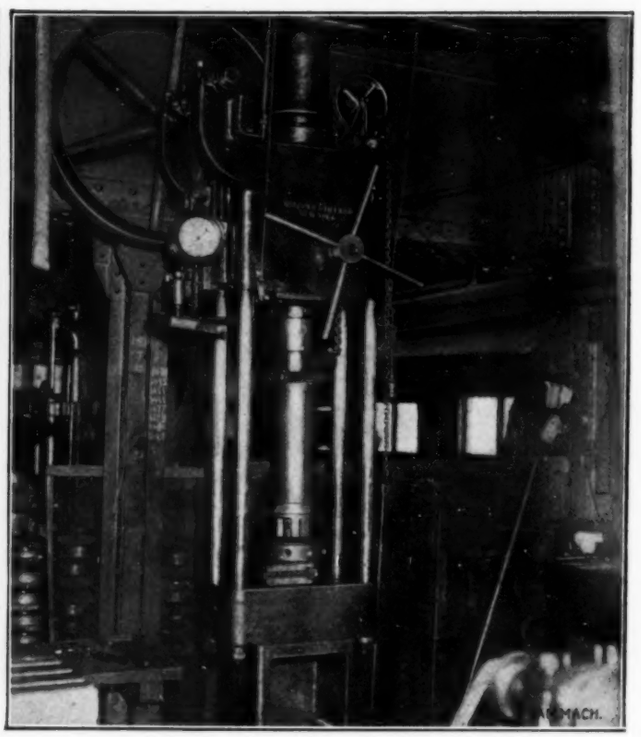


Fig. 18. The Armature Bearing Is Pressed Into the Cover

The mica bush, which serves as a collar for the metal bush previously mentioned, is a comparatively loose fit, so a certain amount of leeway may be allowed in it without lowering the standard of workmanship. The mica V-rings are, on the other hand, required to be as nearly perfect as it is possible to make them; and, with this in view, special machinery has been designed and built to secure uniformity in product. Both the metal bush and the metal V-ring are machined to templates and gages, and no variation is permitted in them.

In building up the copper bars or segments, a temporary bush and V-ring are used, on which the bars with the mica segments between, are first assembled; they are then placed in an oven and baked until they reach a uniform temperature, which is determined by testing each set of bars with a pyrometer. They are next lightly clamped in a split, tapered steel collar; the temporary bush and V-ring are then removed, after which a solid steel ring is forced over the collar at a very heavy pressure. The whole is allowed to cool, and the Vs are then machined.

A careful inspection under a magnifying glass is now made, the edges of the bars are freed from any burrs and a test for short-circuits is given. The metal bush is next provided with its mica collar, and is then inserted in the assembled commutator bars, the mica V-rings being placed in position at the same time; the metal V-ring is finally put in place and the bolts for holding the parts together are screwed down tightly. The ring surrounding the bars is removed and the commutator turned to size. Further test for short-circuits and grounds is given, the bars are slotted for the armature-coil leads, the slots turned and the completed commutator receives a final inspection and test.

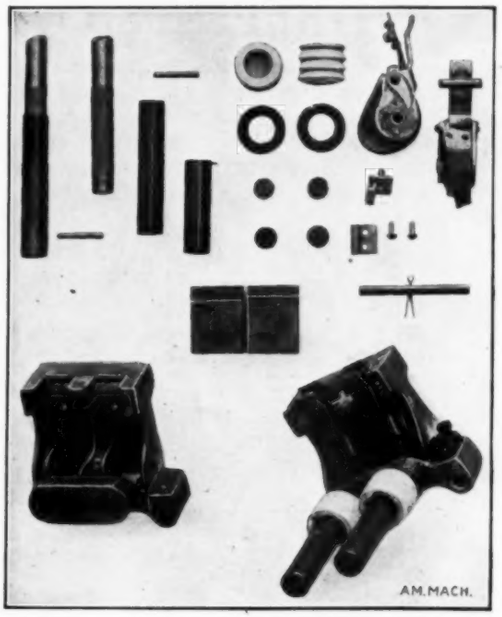


FIG. 19. A TYPE OF CARBON HOLDER

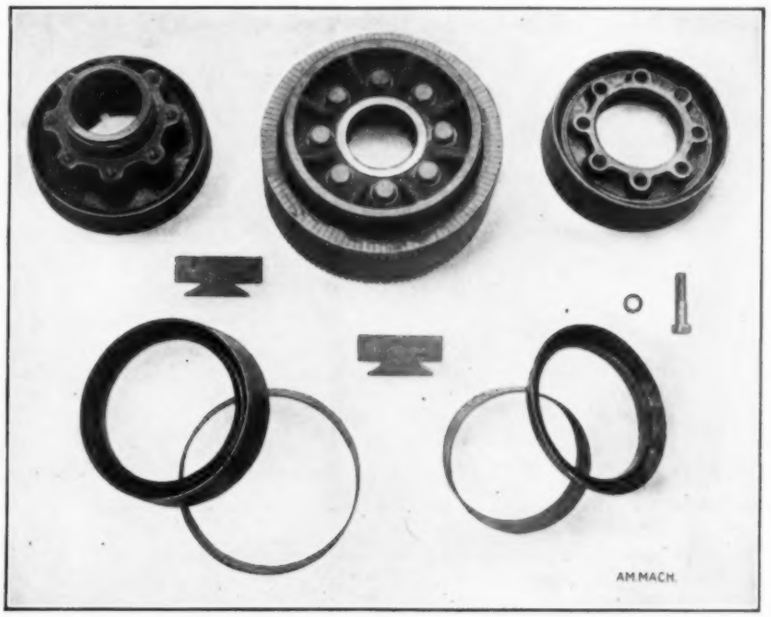


FIG. 20. THE COMMUTATOR AND ITS COMPONENTS

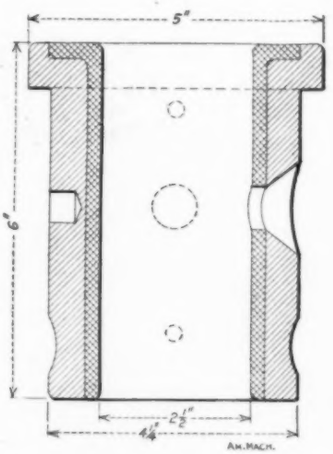


FIG. 21. A SOLID BABBITT-LINED BEARING

BEARINGS

Bearing Operations—Bearings may be either of malleable iron or of bronze and babbitt lined in both cases, or they may be of bronze alone. In the latter case, it is frequently the custom to wipe them with tin, so that upon first being put into service, the axle or shaft will have a better opportunity of bedding itself properly than when this is not done. A one-piece or solid, babbitt-lined bearing 2½x6 in., is shown in Fig. 21.

While the description here given will apply more particularly to one-piece or solid bearings, the general procedure is much the same as with two-piece or split bearings.

The first operation in the making of a bearing is that of freeing the casting from foundry sand or scale by brushing, scraping or pickling it. If the casting is damp, either from pickling or as a result of being stored outdoors, the greatest care must be exercised in seeing that it is thoroughly dried before babbitting; otherwise trouble is likely to be encountered, especially if the casting contains anchor holes, due to the formation of steam, with consequent explosions and scattering about of the babbitt, possibly on the workmen. After cleaning, the casting is chucked in a lathe and the flange is faced, turned and counterbored, and the bearing itself is usually bored at the same time.

One form of mandrel that is used for babbitting is shown in Fig. 22. As will be seen, it consists of seven pieces—base, core, four segments and collar—of which the last is simply for the purpose of holding the other parts together when in use. The core and the four segments are tapered on their adjoining sides, so that after a bearing has been babbitted and the collar removed, they may be readily drawn out. The mandrel is made from 0.004 to 0.20 in. smaller than the finished diameter of the bearing, depending upon the size.

FIG. 22. ONE OF THE MANDRELS USED FOR BABBITTING

The bearing is placed over the assembled mandrel, flange end down, lying perfectly flat against the base on account of the flange having been previously

faced. The base being provided with a rim, also holds the bearing central, since the flange has already been turned. The depth to which the flange has been counterbored determines the wearing depth of the babbitted collar, while the depth of the bore in the bearing proper, likewise fixes the wearing depth of the babbitt in it.

The cored oil holes are next plugged with wood or metal to retain the babbitt while being poured. After pouring, the plugs and the mandrel are first removed and then all fins of babbitt are burned away with a hot soldering iron. The bearing is next bored or broached, after which it is driven upon a mandrel and turned in a lathe. The final operation is that of profiling on the outside for a keyway or drilling for a dowel pin. It is customary to cast the oil grooves in bearings of this type when pouring the babbitt; but, if this is not done, the grooves may be cut in either by hand or by machines regularly designed for this purpose, and at any time after the babbitt has been poured.

Unit Concrete Shop Construction

Editorial Correspondence

A machine-tool erecting shop having concrete columns made by the unit system, concrete and brick sidewalls and a wooden roof. The floor is wood on tar concrete.

The system of artificial lighting has been carefully worked out, using 150 watt 110-volt tungsten lamps.

Unit costs are given.

In Vol. 35, beginning on page 433, we described the unit system of concrete construction developed by E. L. Ransome, and used in building a part of the concrete machine shop of the United Shoe Machinery Co., at Beverly, Mass.

Another use of the unit idea has been made in constructing the new erecting shop of the Heald Machine Co., of Worcester, Mass. This, however, is not an extension of the use of the Ransome unit system, but rather the casting of individual concrete members in forms placed on the ground and then the assembling of these members in the frame of the building. The method was not extended to either the roof or floor.

The first illustration, Fig. 1, shows this addition under construction. On the ground can be seen numerous concrete columns and girders ready to be put in place. At the left can be seen a portion of one of the side walls with the forms from which it is cast; and in the middle is seen the framing for the saw teeth of the roof. Figs. 2 and 3 show the work of erecting.

Dimensions and Unit Costs

The building is 221 ft. long by 100 ft. wide, and with the exception of the saw-tooth roof, which is framed and covered with wood, and the brick panels or curtain wall under the side windows, the struc-

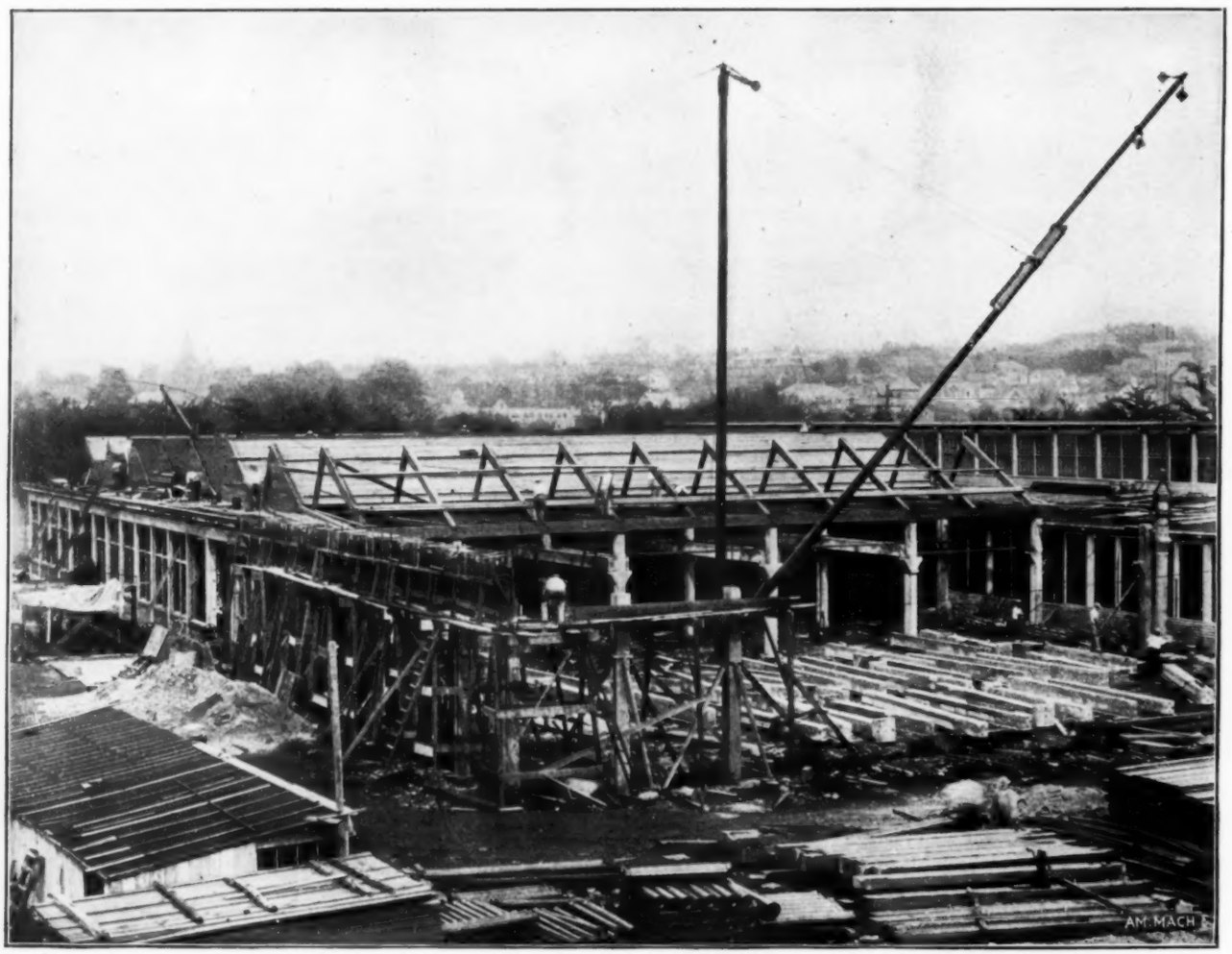


Fig. 1. Addition Under Construction—The Heald Machine Co.

ture is entirely of concrete. The essence of its design and construction was durability. Thus copper flashings were used throughout in connection with the skylight construction. The unit cost per square foot of floor area, including the plumbing, was $1.36.

Before taking up the construction in more detail, it is of value to give the unit costs for two other types of construction that were considered before the final decision was reached.

FIG. 2. CONCRETE COLUMNS AND GIRDERS READY TO ERECT

FIG. 3. CONCRETE COLUMNS AND GIRDERS ERECTED, SHOWING CONNECTIONS

FIG. 4. INTERIOR OF NEW BUILDING—PHOTOGRAPH TAKEN BY NATURAL LIGHT

Prior to drawing the plans, an engineering firm was called into consultation. The recommendation of its engineers was a building of steel construction, having steel columns, purlines, roof joists, etc., with a fireproof type of roofing, such as tile, or a similar material. The floor was to be of a type similar to the one finally used, which will be described later. The estimate on this construction was $1.60 per sq.ft. of floor area. This was not obtained from actual bids, but was the engineers' estimate.

The final plans were drawn by Lockwood, Greene & Co., of Boston, Mass., and the building was erected under their supervision. As originally drawn, these plans called for a roof of reinforced concrete, instead of wood. That is, the roof girders, beams and slabs were everywhere to be of reinforced concrete, covered on the weather side with a suitable composition roofing. A number of bids were obtained on this construction, the lowest giving a unit cost of $1.70 per sq.ft. Others ran as high as $2 to $2.14 per sq.ft. Thus it can be seen that a considerable saving in first cost was made by adopting the construction finally put into effect.

As a matter of appearance, the reader is asked to turn to Fig. 4, in which the sizes of the concrete and wood members are seen to be in harmony. A steel-framed roof would not have given this pleasing appearance, as the steel members would have lacked the massiveness in appearance of the concrete members, with which they would have been brought in contrast. This objection would probably not have held as strongly for the concrete-framed roof, although the concrete members would have been much smaller in cross-sectional dimensions, than the timbers.

DETAILS OF THE CONSTRUCTION

Turning now to the details of construction, and beginning with the floor; this consists of tarred cobble stones, laid on the soil, and rolled into a compact layer. On this was rolled a layer of finer material, then an under floor of sand-tar concrete, 4½ in. thick, on which was bedded an intermediate floor of 3-in. hemlock plank. This was covered by a 1-in. diagonal-lining floor of North Caroline pine, which in turn was covered with a finished floor of 1-in. square-edged maple. Thus considerably more attention and expense was given to this feature than is accorded the usual shop floor. Underneath the floor two 24x18-in. concrete trenches are provided for pipes. One runs lengthwise of the building, the other crosswise.

The shop floor is divided into five lengthwise bays, each 20 ft. wide, set off by four rows of 14-in. square, reinforced-concrete interior columns. These columns are plainly shown in all five of the accompanying halftones. Each column carries two brackets supporting reinforced-concrete crane girders. The distance from the upper face of this bracket, that is, the distance from the underside of the crane girders to the floor, is 10 ft.

4 in. The distance from this same point to the underside of the roof beams is 4 ft. 5½ in.

The manner in which the columns and girders are fastened together is well shown in Fig. 3. Four ¾-in. anchor bolts pass through the girders and column, use being made of sections of 1½-in. pipe imbedded in the concrete when cast as a means of entering the bolts. The longitudinal reinforcing bars of the crane girders are bent over these bolts. The crane rails are located 3 in. from the outside edge of the brackets and are fastened to the girders by clips.

The side walls are of concrete, with the exception of the curtain walls, which are of brick. The windows range in width from 7 to 8 ft. with a general height of 11 ft. Each has three sash, of which the top is pivoted, the middle stationary and the bottom slides upward.

The roof beams are of 10x16-in. hard pine, lag-screwed to cast-iron caps, which in turn are bolted to the tops of the concrete columns. This general construction is well shown in Fig. 4. The rafters of the saw-tooth roof are also of hard pine, covered with 3-in. planking, which in turn is protected by a five-ply tar and gravel roof. The glass area is 6 ft. in height, and extends the full length of the roof. The skylights are double-glazed, on the outside with ¼-in. ribbed glass, and on the inside with double-thick clear glass. Extending the length of the roof are two rows of 18-in. globe ventilators.

Provisions for Heating

The building is heated by direct radiation from pipe lines located under the glass area in each bay to warm and temper the air from any drafts which might enter at these points, and on three sides of the building under the windows are fitted radiators of the hospital type. The cost of the heating apparatus is approximately 9c. per sq.ft. of floor area.

Provisions for Artificial Lighting

For lighting purposes, the shop is divided into four sections running crosswise. The units selected were 110-volt, 150-watt tungsten lamps, carried under holophane metallic reflectors of the extensive type. As the shop current is 220-volt direct, a three-wire system was installed, the lamps being inserted on each side of the neutral wire. This system called for the installation of a balancer set to maintain uniform voltage on each side of the circuit, so that the turning off of any lamps would not tend to unbalance the system to the detriment of other lamps still in use.

Fig. 5. Interior of New Building—Reproduced from an Unretouched Photograph Taken by Artificial Light

The cost of wiring, lamps, balancer set, switchboard, rheostat, etc., was approximately 6c. per sq.ft. of floor area lighted. That the final results are most satisfactory is shown by Fig. 5, which is reproduced from an unretouched photograph taken in the shop at night, with no light other than the regular artificial light from the system just described. The quality of this illumination can better be judged by comparing Fig. 5 with Fig. 4. Fig. 4 is an interior view of this shop taken with natural light. The photograph from which this illustration was made was not retouched.

The price quoted above further includes wiring for the electric cranes, and the installing of outlets on interior columns at convenient points to tap off current for portable electric drills, hand lamps and other apparatus.

The precise location of the tungsten lamps is shown in Fig. 5. In general, they are spaced 10 ft. apart, lengthwise of the shop, one row placed between the crane girders, where they are completely out of the way and protected from mechanical injury, the bottom edge of the shade being on the level with the bottom of the girders, and another row down the center of each bay on a level with the underside of the roof beams. This central row is high enough to clear the cranes.

The excellence of the illumination is still further increased by the fact that the roof with its beams, columns and crane girders, is all painted white, thus materially aiding the uniform diffusion that is obtained. Further, all of the light is directed downward, and none in a horizontal direction, thus tending to do away with any objectionable glare. That this method of illumination does not give an unpleasant contrast between the amount of light above and below in looking from one side of the shop to another, is amply shown by Fig. 5.

The Shop Adapted to Its Intended Use

As mentioned at the outset, this shop was built primarily for erecting purposes. The adoption of the saw-tooth type of roof with a craneway over each bay gives a floor area well suited for an assembling department. The type of electric cranes installed is shown in Fig. 4. These are easily operated and are directly under the control of the men who are doing the assembling. Thus a special crane operator does not have to hold himself in readiness for calls from any part of the floor, as would be the case with a single large traveling crane covering a floor area, such as is commonly found under the monitor type of building construction.

An Asbestos and Graphite Mixture for Plugging

By Donald Baker

In hardening dies and punches in which there were screw and dowel-pin holes it has always been my practice to plug the holes with asbestos, either the wick or granulated.

After hardening I have had more or less trouble cleaning out the holes as the asbestos would be baked on. I have found that by first mixing the asbestos with graphite and oil and plugging the holes with the mixture, the holes are very easily cleaned and are entirely free from scale, etc.

Churchill Cylindrical Grinders

The development of cylindrical grinders has received considerable attention from Charles Churchill & Co., London, England, and some of the features of their new universal grinders are of interest.

Beginning with the headstock of the universal grinder shown in Figs. 1 and 2, it will be noticed that this can be used for driving with either a live or dead center, this being made clear by referring to the sectional view in Fig. 2. The pulley at the left is locked fast to the spindle, while the double pulley turns freely on the projecting end of the spindle, when the spindle is held stationary, by means of a locking pin, shown at the back of the head of the tailstock. The construction of the bearings can be plainly seen; the live or fixed driving pulley is between the two bearings, making a very substantial head.

Editorial Correspondence

Some of the interesting features of a new universal grinder manufactured abroad. A British company's solution of the grinder problem that is giving satisfactory results.

The Tailstock

The tailstock construction is shown in Figs. 3 and 4, the usual spring tension being provided to allow for the expansion of work during grinding, the barrel being fully inclosed, as can be seen by the detail in Fig. 4. The tailstock body is split and fitted with an adjusting screw for taking up the wear. It is also furnished with a convenient clamp having knurled thumb-screws for holding the diamond tool when the grinding wheel is to be trued, as well as a shield to protect the barrel from water and dust. These details are noticeable in both Figs. 3 and 4.

The Crossfeed

The automatic crossfeed can be set to advance the wheel into the work by a definite amount at each stroke. To accomplish this, the graduated quadrant shown in Fig. 5 is used. These graduations indicate the setting to feed any required number of teeth on the ratchet at each reversal of the table. The movable dogs on the table, coming in contact with the foot lever, throw it over, and in so doing press down the spring plunger with which it makes contact, whenever the automatic feed is in operation. This

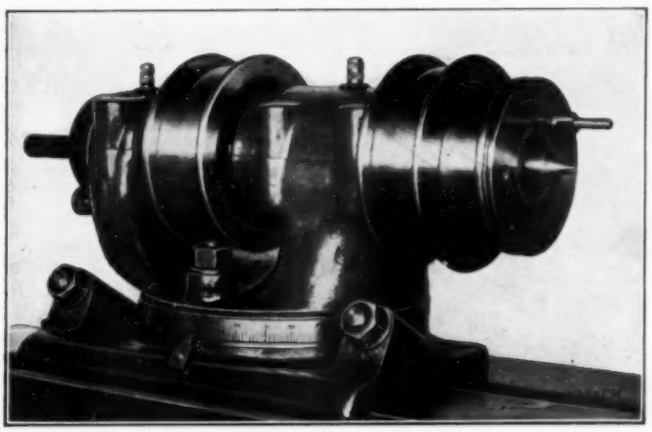


Fig. 1. Headstock with Double Drive

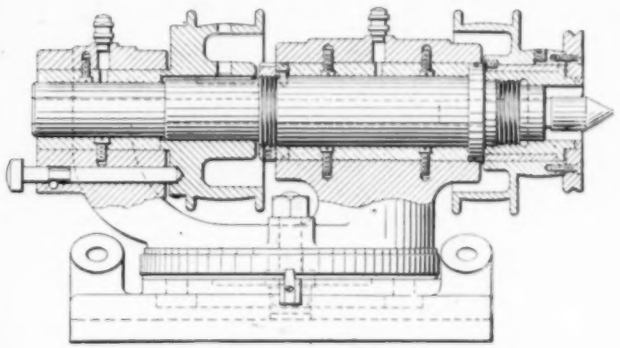


Fig. 2. Section of Headstock

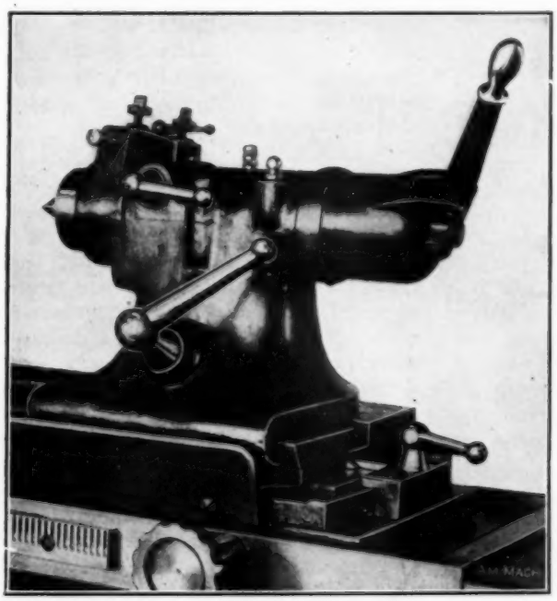


Fig. 3. The Tailstock

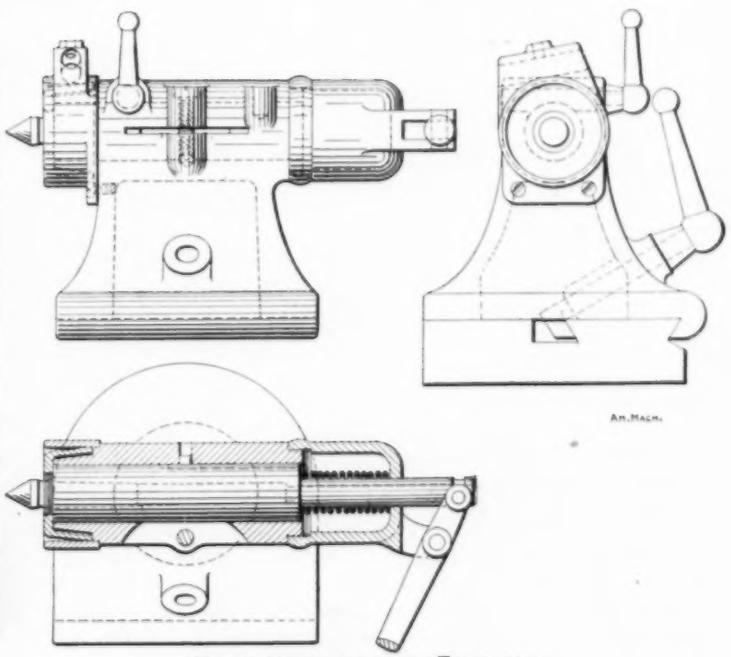


Fig. 4. Details of the Tailstock

arrangement gives a uniform feed at each end of the stroke without the need of any special adjustment. The handwheel is graduated to show thousandths of an inch on the diameter of the work, and the ratchet has four teeth to every graduation on the handwheel. This makes it possible to secure a reduction in the diameter of 0.00025 in. The trip cam for disengaging the feed corresponds to the ratchet wheel and can be rapidly and exactly set.

The indicator on the small dial in front of the index wheel, when moved a given number of spaces forward or back, traverses the trip cam a corresponding number of teeth around the ratchet wheel. Fig. 6 shows the feed gear thrown out of action by swinging the quadrant out of contact with the plunger.

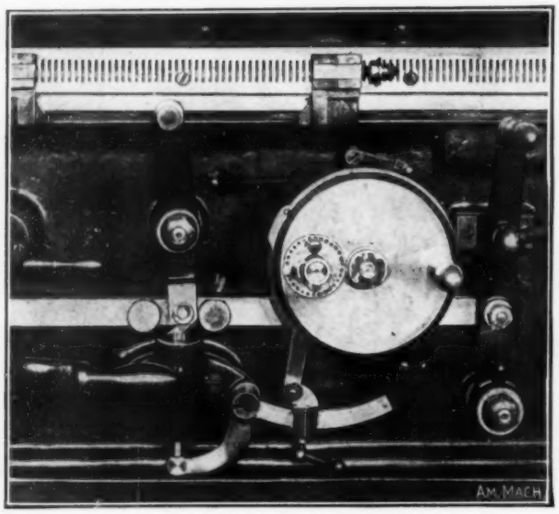


FIG. 5. THE CROSS-FEEDING MECHANISM

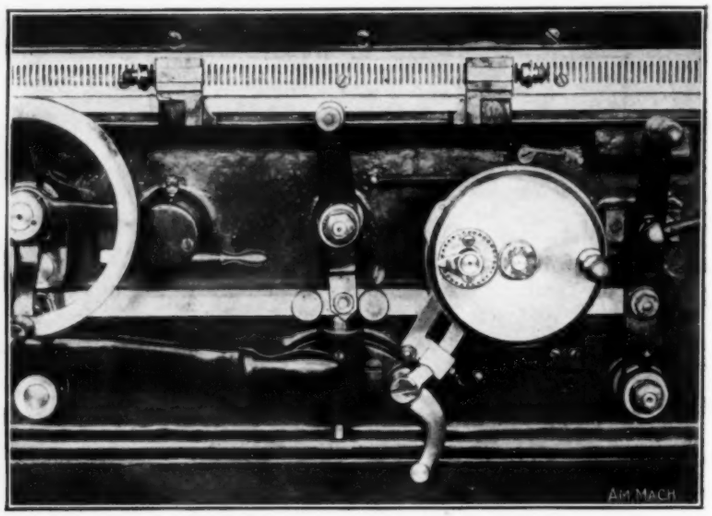


FIG. 6. DISENGAGED FOR HAND FEEDING

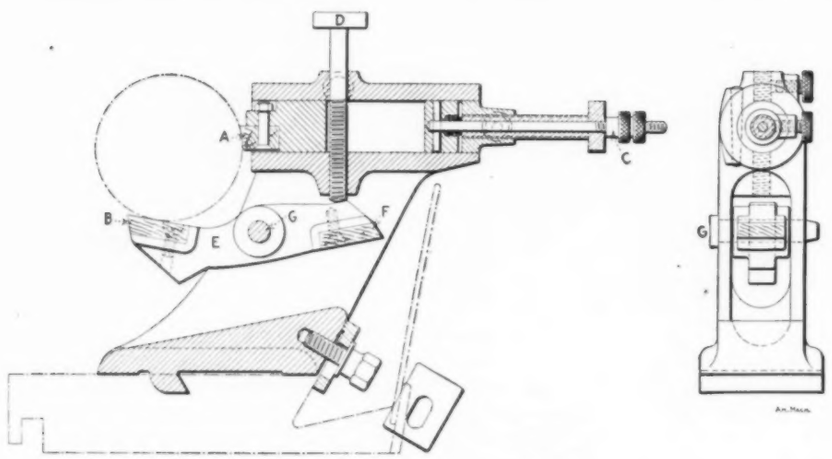


FIG. 7. ADJUSTABLE STEADY REST

THE STEADY REST USED

The form of steady rest provided with these machines can be seen in Fig. 7. Hardwood blocks *A* and *B* are used, these being held firmly in position against the work by the methods shown. The block *A* is fed directly against the work by the adjusting screw *C*, while the lower block *B* is adjusted by means of the vertical screw *D*, which can force it up against the work with any desired pressure.

It will also be noted the arm *E*, which carries the bottom block, is reversible, so that either blocks *B* or *F* can be thrown in contact with the work. The arm *E* is easily reversed by simply withdrawing the pin *G*, removing the arm through the opening in the casing, reversing its position and again inserting the pin.

Thread Cutting on a Vertical Mill

BY H. A. PETERS

A recent article in the AMERICAN MACHINIST reminds me of a job we did cutting a single ratchet thread in 16 cast-steel nuts, 16 in. in diameter and 20 in. long. They were first faced and bored within a thirty-second. Having a six-foot mill with a two-speed countershaft, we crossed the high-speed belt for running backward.

A lead screw and nut were made the same pitch as the thread to be cut. The nut was put into the hole in the table and bolted fast by a flange. The screw fit the taper hole in the boring bar; the tool-holder was fast to the screw forging, and being a square hole with clamping and adjusting screws, was very rigid and free from chatter. In operation the nut to be cut was placed on four 4-in. blades, to give hand room underneath, and securely fastened down.

The boring bar was set central and locked there, and the hole finish-bored with a double end cutter. The lead screw was then entered in the nut and made fast to the bar. The bar having friction feed, it was only necessary to release the friction, leaving the bar free to follow the screw up or down. The tool was removed at the bottom of the cut and the machine reversed, backing the tool-holder up to the starting point.

While this may seem an expensive method, on a long awkward job it proved economical and satisfactory as the mill was served with an electric jib crane; and consequently one man was able to handle the job without any help.

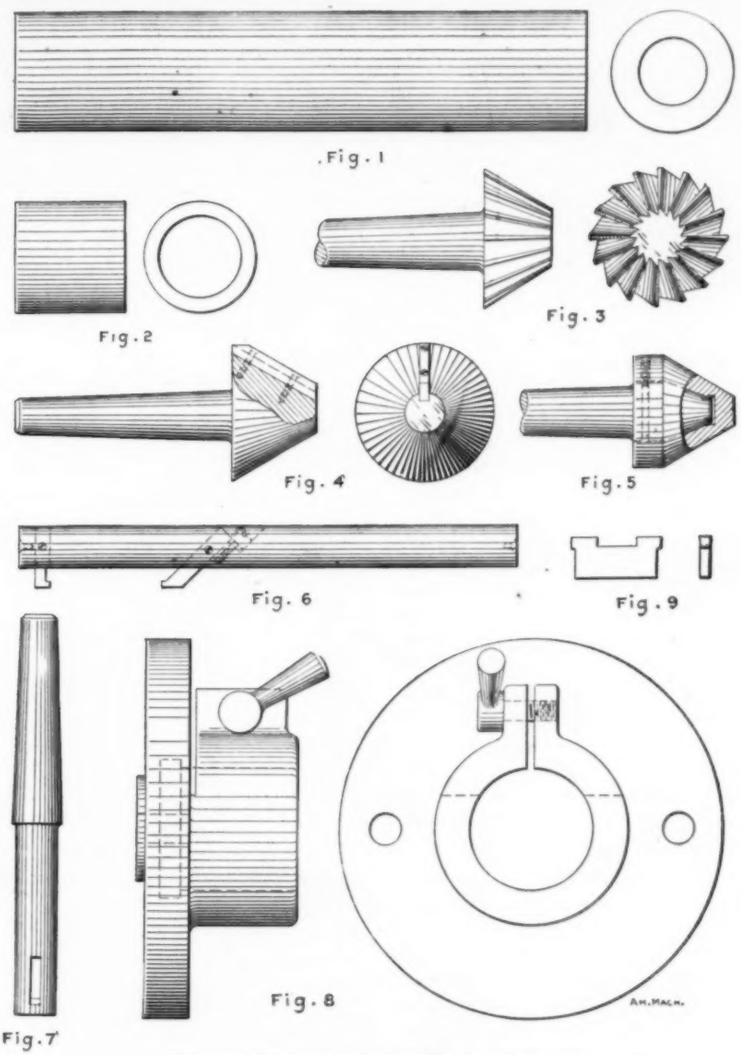
In England steam engines furnish the bulk of electric power in public electricity stations. A few Diesel oil engines are in use, mainly of very small size, and there are a few medium-sized gas engines. One or two stations have water power, but none of these have so far seriously challenged steam. In Germany things are different. It appears, states a contemporary, that of the public electricity works in Germany, 800,000 kw. is installed in exclusively steam stations, 400,000 kw. in gas stations, 250,000 kw. in water-power stations, and 400,000 kw. in combined water and steam stations. These figures are certainly remarkable when viewed in the light of the position in England.—*The Engineer.*

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Machining Bushes on the Engine Lathe

The accompanying diagrams, describing tools and fixtures for machining Lumen bushes, came under my notice where I was employed, and are presented in modified form. There were several hundred bushes to make. At first thought one would suggest the turret lathe for such a job, but circumstances did not permit the installation of such a machine at that time.



MAKING BUSHES IN THE ENGINE LATHE

A casting 14x2 1/16 x1 1/16 in. is shown in Fig. 1. Fig. 2 is the finished bush, 2x2x 1½-in. bore. The order of the operations follow: Center the ends of the castings with the tool, Fig. 3, under the drilling machine in a vertical V-block having a quick, cam-acting clamp for holding the work; cut by hand a groove 1/16 x1/8 in. at one end for driving purposes; turn the outside diameter with the use of centers, Figs. 4 and 5, the latter being made 2 in. in diameter, was used as a gage for setting the tool; with the use of the fixture, Fig. 8, set off the approximate length; rough bore, with the bar, Fig. 7, and cutters, Fig. 9, made 0.010 in. under finished size; finish bore and machine to length with the tool, Fig. 6.

When boring, the tailstock was brought up as close as the work would permit, and once set was not moved until the operations were performed on all the bushes, thus allowing them to be rigid and maintain the same adjustment throughout the operation. The tools in the bar, Fig. 6, are machined to size with the bar on centers; provision is also made for adjustments in case of wear or regrinding, which does not occur very often as the work for this tool is very light. When finishing the bore, the tailstock is so set that the sizing tool, Fig. 6, may be brought into action at the one chucking.

The clamping handle on the fixture, Fig. 8, was always brought to a given point, thus insuring uniform pressure on the work, especially when finishing the bore, which, of course, took less pressure than the roughing operation. The method applied enabled the work to be held very rigid, resulting in an almost perfect round and concentric bush.

W. J. BILTON.
Thornton Heath, England.

Repairing Boilers by Welding

In a horizontal return-tubular boiler the rear head was so badly corroded and wasted away around the handhole that the inspector ordered a reinforcing piece to be put in. After the head had been cut away until only the plate of full thickness remained, the reinforcing piece was slipped inside and four rivets, as shown in Fig. 1, were put in. The cutting of the head and of the handhole in the reinforcing piece was done with an oxy-acetylene flame. The plate was then welded on the line indicated in the sketch and steel was welded over the rivets. I could not understand why the inspector ordered the rivets put in, as all of the strains are of compression, there being no part in tension. The boiler is under steam at the present time and is perfectly tight.

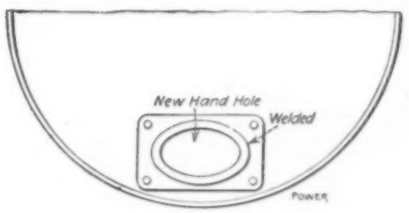


FIG. 1. REINFORCED HANDHOLE

Of a battery of seven Manning boilers, six were wasted away on the fire

side of the furnace sheet so that it was deemed necessary to either cut out the sheet, part of the way around, for about 60 in. long and 8 in. high, or to build up the sheet by the oxyacetylene welding

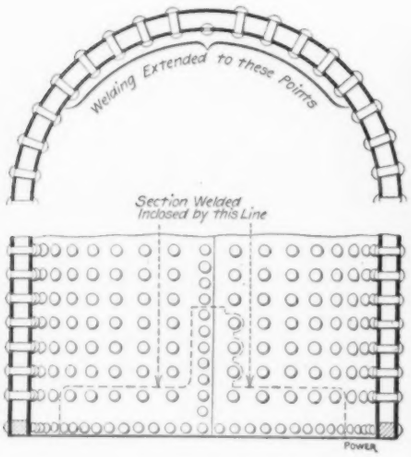


FIG. 2. WELD APPLIED TO MANNING BOILER

process. After carefully looking the matter up it was decided to try the welding. The metal to be added varied from 3/8 in. in thickness down to nothing and the area was about like that shown in Fig. 2.

The reason for running up the vertical seam as shown in the figure was that the outside sheet had been trimmed so close to the rivets to get a calking edge that it was impossible to make the calking hold for any length of time.

The heads of the rivets in the bottom ring and the lower row of stay-bolts were welded over, as were the rivet heads at the vertical seam. The sheet around the bottom ring had to be built up below the rivets so as to get a calking edge.

Under hydrostatic test, six stay-bolts were found broken, probably due to expansion and contraction strains; also the fatigue of the metal must be taken into consideration as the stay-bolts had been in about 16 years. The advisability of welding the vertical seam is questionable, it being a lap joint, and expansion and contraction cracked the weld in places, necessitating the cutting away of the welded edge and calking the joint. The welding of the fire-cracks around the door was successful.

It is evident that welding reduces the cost of repairs more than one-third and does away with the possible, and probable, future trouble with the extra seam in the furnace sheet, which would have been necessary had the work been done by cutting out of the defective sheet and putting on a patch. Also, it was not necessary to move the boilers from their positions, a portion of the base plate, the grates and part of the outer covering being all that it was necessary to remove.

Adams, Mass. F. R. PRATT.

A Remarkable Planer Job on Cast Iron

From time to time there have been articles in the AMERICAN MACHINIST on the subject of accurate planing. Many of these jobs have been done on planers especially gone over and fitted for accurate work.

A REMARKABLE PLANER JOB

The cast-iron plate and stand shown in the illustration were noticed in the shops of the Waterbury Farrel Foundry, Waterbury, Conn. It is a rectangular plate, about 6 ft. 6 in. square and about 3 in. thick, with two 60-deg. V-tracks, one on each side, and a flat track in the center, parallel to the Vs. Nothing remarkable about that, but on closer inspection it was observed that in each angle of each V, and at all four corners, there was a piece of tissue paper. Nothing very remarkable about that either, but under each end of the flat track in the center there was also a piece of tissue paper and the plate was resting on these ten pieces of paper.

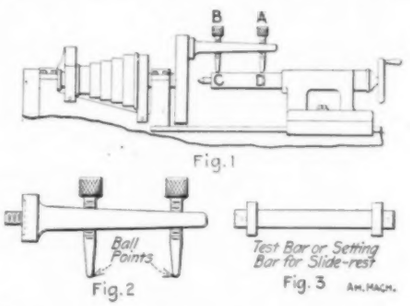
Further; the job was somewhat wider than the table of the planer on which the work was done; the planer is used for all kinds of work, rough and fine; something very remarkable about that.

W. J. Phippney, who did the job, rough planed it all over and laid it aside to season for a while. The stand was treated the same. Then the plate was finish planed, and, when the table was finished, the plate went into place just as stated, without any fitting. A lot of good money, no doubt, could be saved if someone would start building lathes, planers and other tools this way, leaving off all that fency frosting. In many cases it means less than nothing, as far as accuracy is concerned, and from my own experience, I can say that the prettiest example of frosting (from the art confectioner's point of view) I ever saw was not within 30 sec. of being flat.

New York, N. Y. E. A. DIXIE.

Practical Lathe Headstock Adjustment

The method consists of trammeling from the live spindle to the tail spindle. I proceed, with the two heads ready assembled, on a bed that has been accurately leveled, and which is absolutely free from crosswind. The trammel is mounted on the faceplate finger *A* in position. The tail spindle should project outward, about three-fourths of its length, or as far as convenient, and should be locked in position. It is assumed that the barrel is perfectly cylindrical. The tail spindle is now tested with finger *A* only,



PRACTICAL LATHE-HEADSTOCK ADJUSTMENT

at points *C* and *D*, as shown, and on the four quarters around these points, that is, on top and bottom, and the two sides. The tailstock is now adjusted by scraping, until the "feel" between finger *A* and the tail spindle is absolutely equal at all points. It will be noticed that in turning from side to side, what error exists is shown doubly. It may be found necessary to lower the headstock in accordance with the tailstock; i.e., to keep center heights the same.

When the tailstock is perfect, operations are transferred to the headstock. Finger *B* is screwed into the trammel, and by the use of the two fingers, the headstock is now squared, from the tail

spindle, until the "feel" is equal at all points. Care must be taken while doing this to keep the center axis of the two heads right and in line. Should it be necessary to do further adjusting at the tailstock, the latter must be thrown bodily, it may also be necessary to check the tail spindle using the one finger *A* again. Lathes made in batches, where the heads are bored in good jigs, may not require much adjusting, but this is a good method as a final check, and the accuracy which it insures is quite necessary in many present-day toolrooms and workshops.

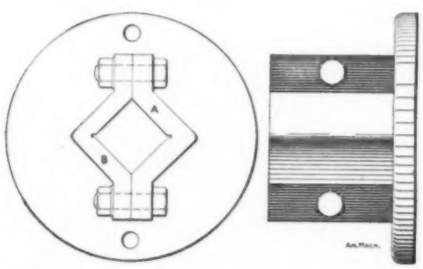
In place of the threaded fingers in the trammel, micrometer heads or suitable indicators could be used. Personally I prefer the ordinary screws, with lapped ball points, as I find them more convenient. With a little experience, a remarkably fine "feel" with paper can be obtained.

A very handy setting bar for setting the slide rest parallel to the centers, when doing short jobs, is shown in Fig. 1. I have frequently noticed tool makers tap the rest round during an operation to bring the rest right; I have had to do it myself, where the graduation lines for degrees were thick and clumsy. As it is impossible to set accurately to zero mark within a thousandth or two, for reasons which are obvious, this tapping should be avoided. The setting bar is made of hardened steel, centers are ground, also the two collars, which are both ground dead accurate to the same size. In use the bar is mounted between centers, and slide set, with use of an indicator, measuring on the two ground collars.

Leicester, England. T. POWELL.

Special Chuck for Lathe or Driller

The diagram shows a special chuck which I use either on the lathe or driller. *A* is a fixture cast on the base and *B* is the loose part. I occasionally have to bore screw holes in square pieces, which



SPECIAL CHUCK FOR LATHE OR DRILLER

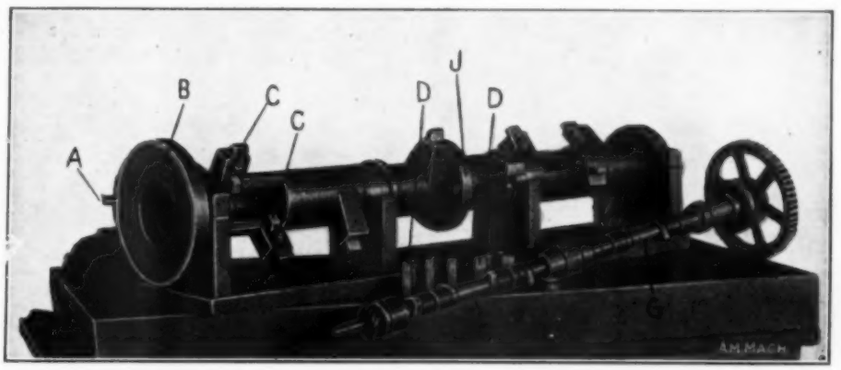
are out of center, and having set the chuck on the faceplate correct for the first one, it does not require setting again throughout the job. Sometimes I have to face pieces with flanges. On this I find the body acts as a stop, and thus I am able to keep the flange the same thickness. On the driller it is useful for drilling holes through the flanges, as it supports the work.

WILLIAM VINCE.

Birmingham, Eng.

A Cam Setting Fixture

The illustration represents a fixture for holding the cams of an automatic camshaft in their exact, timed position, while being drilled to receive the taper pin which permanently holds them in position.



FIXTURE FOR HOLDING CAMS WHILE DRILLING THEM

The fixture consists of a base having four supports for the barrel *B*, which revolves thereon. The camshaft is first assembled, as shown in the illustration, the cams being located approximately, so that when the camshaft is inserted into the barrel, each pair of cams can be located by advancing the sliding jaws *C C*. The split collars *D D* serve to give support to the camshaft in the spaces *G G*. The flange *B* has a locating finger *A*, which drops in between two teeth of the camshaft gear. This space is marked before the camshaft is withdrawn.

For convenience in boring, the barrel is flanged at *J*, and to facilitate the removal of the camshaft after drilling, the barrel is stepped in the bore. The fixture is simple in construction and has proved a tremendous labor saver.

Hartford, Wis. A. J. DUDLEY.

Power Required to Drive Reamers

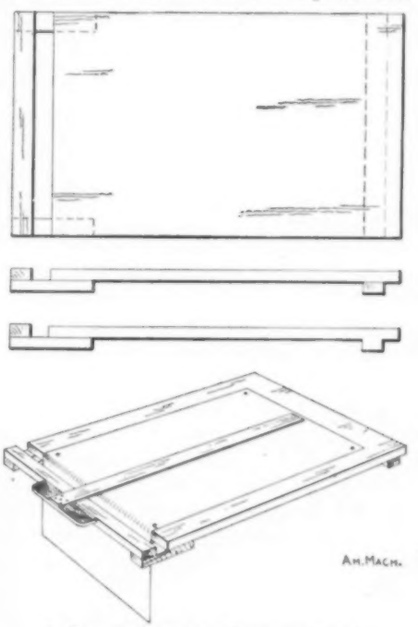
Recently we wrote three manufacturers of reamers and one of our prominent colleges, asking if they had ever made tests as to the difference in power consumed between three-groove spiral chucking reamers and four- or six-lip parallel reamers. None of them had ever made any tests and knew of no results they could refer us to. With so much being written on efficiency and economy in manufacturing, is it not rather curious that there should be no data on this subject?

I have used both kinds and know there is a vast difference in the amount of power required to drive these reamers. The feed that can be used with spiral reamers is much greater than with parallel reamers and it requires much less care for the belts. In fact we can almost feel safe in saying that the saving is 50 per cent. We can get the data necessary as to rake, clearance, etc., on lathe or planer tools, also on drills; we can get the horsepower consumed in driving these tools with these various clearances and angles, but who can tell us the difference in horsepower consumed between three- to six-lip parallel reamers?

Auburn, N. Y. A. A. BERTRAND.

Drawing Board Improvement

The illustration is that of a drawing board which can be used for making drawings of any length. The opening between the board and the T-square rest



A DRAWING-BOARD IMPROVEMENT

enables the paper to be drawn through so that the drawing may be of any desired length. ARTHUR MCALPINE.

Auburn, N. Y.

Cranked Screwdriver

The accompanying line cut represents a very simple and useful form of screwdriver, with which I recently became acquainted. The shop has various sizes for different size screws. This screwdriver is made from drill rod. One end is forged similar to the tang of a flat

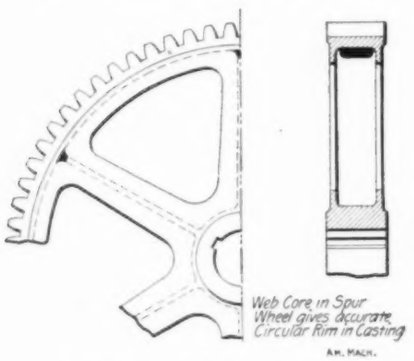
A Screwdriver

file. The crank is bent, the end cut to length, and flattened to the size of the screw slot. The handle *A* is a file handle fitted to the shank as a file is fitted.

Portsmouth, N. H. Frank Rose.

Casting Heavy Steel Gears

Heavy cast-steel gears are used in rolling mills for all purposes. The H-section of the arm is usually adopted when the wheel is cast in one piece. Frequently the rim shows out of true before machining in the lathe. This is due to the unequal contraction of the heavy mass of metal on the rim—very necessary metal, however, when it is mentioned



Casting Heavy Steel Gears

that wheels of 72 teeth, 4 in. circular pitch, are among the smaller sizes.

The difficulty is overcome by making a small cored hole, as shown in the illustration, through the webs of the arms at the joint with the rim. This prevents the earlier cooling of the thin webs from affecting the truth of the rim, and tends toward uniform cooling of the rim and the hub through the heavier section metal of the flanges of the arms.

The resulting castings are perfect, and economy is effected both in the weight and subsequent machining. It may be of interest to note that the teeth are involute 18-deg. angle, total height of tooth 0.55 pitch. The method of cutting is slotting.

Andrew W. Robertson.

Montreal, Can.

Cutting a Pinion on a Planer

Some time ago I had two 14-pitch, 18-tooth pinions to cut for two special machines, and having no miller or gear cutter of any kind at hand, had to make shift to get the job done.

I took a 72-tooth gear from a set of lathe change gears, marked every fourth space and pressed it onto a mandrel about 6 in. long. I fitted one of the pinions on the other end. The 72-tooth gear I caught in a shaper vise, which we used on a 24-in. by 5-ft. planer, dropping the gear far enough down so that it rested on the corner of the vise-ways at *A* and *B*, Fig. 1, and that the corners of the vise-way *B* would come between two teeth and in one of the spaces that I had previously marked, as at *I*, Fig. 1, in this way presenting the pinion blank to the tool, as shown at *C*, Fig. 2.

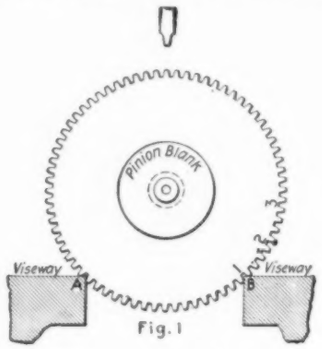


Fig. 1

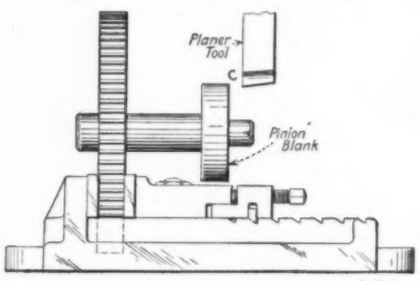


Fig. 2

Cutting a Pinion on a Planer

By adjusting the tool over the center of the blank so that it would just touch, then setting the micrometer downfeed dial at zero, starting the cut and feeding the tool in the required number of thousandths (0.1541), I finished the first cut. Then by opening the vise and rotating the 72-tooth gear so that space 2, Fig. 1, came over the corner *B*, I was ready to proceed with the second cut, and so on around the blank, which, when finished, looked much better than when done on a miller.

The time made on the first pinion was so good that it prompted me to get the exact time on the second, which, from starting the cut on the first space to the finished job, took just 19 minutes. This I regard as a pretty good showing against some of the modern gear cutters.

H. E. Skelton.

St. Louis Park, Minn.

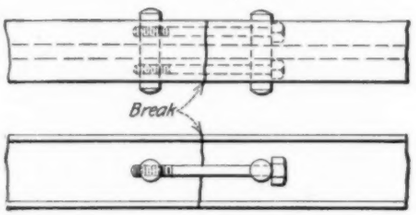
[This way of doing the job is all right, providing *A* and *B* are spaced so that the gear fits as shown in Fig. 1, but where the gear does not fit, care has to be observed that the gear is held exactly the same for each tooth cut.—Editor.]

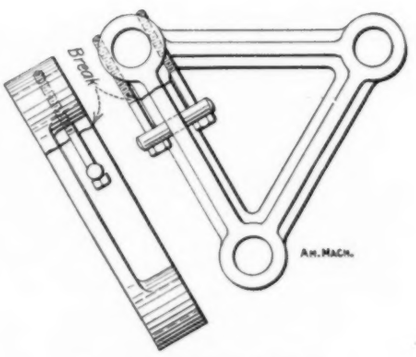
Two Uncommon Repairs

Two repairs which we recently made of machine parts which broke clear in two make use of an idea or principle which I think could be used in many repairs to advantage.

The diagrams show the repairs clearly and need but little explanation, the idea being to *draw together* the broken parts into the original position and keep them there.

An overhanging arm on a splining machine is shown first. This is of I-section cast iron. A hole was drilled each side of the break, two pieces of cold-rolled steel were drilled and tapped, and with two bolts from the stockroom the parts were ready to put together, and the arm was nearly as strong as new.





Two Uncommon Repairs

The second repair job was an arbor support on a gear hobber and was exactly similar, except that we were able to tap into the iron itself on one side of the break. Such repairs are sometimes made by bolting plates on the sides of the broken parts. This, however, takes longer and does not give the rigidity that our repair has.

Windsor, Vt. T. H. Crumrine.

Discussion of Previous Question

Referring to letters and articles previously published

Hints on the Design of Cams

In his article, "Hints on the Design of Cams," Vol. 35, page 676, Mr. Lawrenz states: "The lever becomes effective, its effective length being OC_2" and lower down in the same column, he says: "If we shift the lever to position OC_3 its effective length is OC_4.". He appears to have taken a horizontal line through C, cutting the vertical OC_1 in C_2, thereby arriving at his effective length OC_2 for position C and similarly OC_4 for C_3. Now are OC_2 and OC_4 the effective lever lengths? I think what follows will prove the answer in the negative.

The effective lever arm of a force about a point is equal to the perpendicular distance of the line of force from the fulcrum. The effective arms therefore in our problem are OE and OB (Fig. 2) for positions C and C_3 respectively, which are greater than OC_2 and OC_4.

By Mr. Lawrenz's method the effective arm at Co would be od, Fig. 1, but as he states, this is a dead center and there is no arm, therefore the method of taking a horizontal line through the outer position of the lever cannot be correct. The method suggested here gives no arm at position Co and at C, the maximum arm of the lever OC, and at this position there is a pure turning moment about the fulcrum O.

With regard to the effective pull of the spring should not this be proportional to $C.D + C_0E$, $C.D + CA$ and $C.D + C_2B$, Fig. 3, and not proportional to $C.D + CC_2$, etc.?

Yorkshire, Eng. A. BURTON.

The Growth of Cast Iron by Heating

The article in Vol. 35, page 968, entitled "The Growth of Cast Iron," recalls an experience we had in connection with this subject.

Our experience was with a number of cast-iron rings which went wrong. These rings, which were about 7 in. in diameter, had a shoulder turned on them which had to be a tight fit in another piece. When we went to assemble them they were found to be about 0.004 in. small. Recalling what I had read about the growth of cast iron, we decided to try this remedy on a few, and after heating them red hot and letting them cool off we found that they were just the right size to force into the other piece, and the operator was instructed to proceed likewise with the rest of them.

Here is where the trouble began; for the operator, feeling badly about turning the rings too small, tried to make time by dipping one in water in order to cool it more quickly and, after *reassuring* (?) himself that it was not hard by testing it with a file, he treated the rest of them in this manner. After assembling and when we tried to turn these rings they were found to be too hard to turn in a reasonable time. There was nothing else to do but to take them apart and anneal them if possible—yes, they could be annealed but during the annealing they did a lot of growing, in fact so much did they grow that they would not go back into place without breaking the thin-wall casting into which they were forced. We were therefore compelled to chuck them up and take a cut of about 0.005 in. off them, before we were able to proceed with the job.

After this experience we were all convinced that cast iron "do grow." Corroborative of this fact is our experience with a number of cast-iron boxes about 4x5x8 in., used to carburize small steel parts in a gas furnace. These boxes were covered with lids that fitted down over the boxes, and after being heated about 15 or 20 times the lids were so badly warped that they could not be used any more. New lids were ordered from the original pattern but when we came to use them they were found to be about ¼ in. too small. Accordingly a new lid pattern was made ¼ in. larger each way.

Philadelphia, Penn. E. A. ERMOLD.

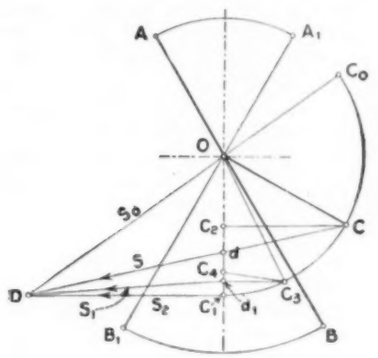


Fig. 1
Copy of Mr Lawrenz's Diagram

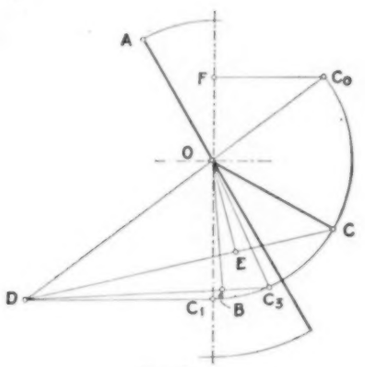


Fig. 2

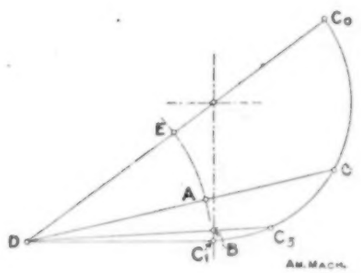


Fig. 3
Corrected Diagrams

HINTS ON THE DESIGN OF CAMS

Some Advantages of the Bonus Plan

For some time past the bonus plan of work had been subjected to considerable criticism, principally as to its disadvantage to the employee. About three years ago the bonus system of work was installed at the Standard Motor Construction Co.'s plant. I have had opportunity to test its operation in various ways, and have come to the conclusion that the criticism is not justified.

The bonus system has a great many advantages over the day-work and piecework systems. It not only earns a higher wage for the employee, but helps him attain greater efficiency. It teaches the em-

ployee the best methods of performing his work, gives his confidence in himself, as, by following his instruction card he needs little help from his foreman. It shows the employee that his employer is interested in him by his willingness to reward him for the extra effort put forth on his part to get the full capacity out of his machine. It shows the foreman who his efficient men are, and with such men about him he can turn out more, better and cheaper work; he has less mistakes to rectify and more time to devote to regular duties, other than directing the work of each mechanic.

It has its advantages over piece-work, as there is no cut in the rate or time except where entirely new methods of doing the work are introduced, and allows the mechanic to earn as much as he is capable of earning. The mechanic realizes that in order to earn bonus on his work he must use his brains and faculties to the fullest extent, thereby gaining confidence in himself and lessening the supervision of the foreman. It shows the employer a marked result in the output of product, a reduction in cost, increased profits on his business and a more cooperative spirit in his men. In general, the bonus plan of work benefits all concerned and compensates as no other system can.

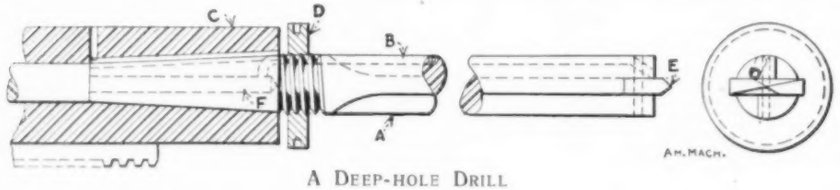
For the greater effort put forth by both employer and employee there is a material increase in efficiency seen throughout the whole plant; tools and machines are of the best and latest improved type; they are kept in as nearly perfect condition as possible, and there is in addition a spirit of coöperation which is essential to a successful business.

Jersey City, N. J. W. L. MYLES.

A Deep-Hole Drill

Seeing the article in Vol. 35, page 916, by G. W. Linn, concerning a line reamer made of machine steel, reminded me of a drill used for drilling deep holes in steel spindles. Before making this drill, we had used twist drills of suitable length, but we found these very expensive, as they were frequently broken.

The stem of the drill *A* was made of machine steel and the cutter *E* of high-speed steel. A groove was cut the length



A DEEP-HOLE DRILL

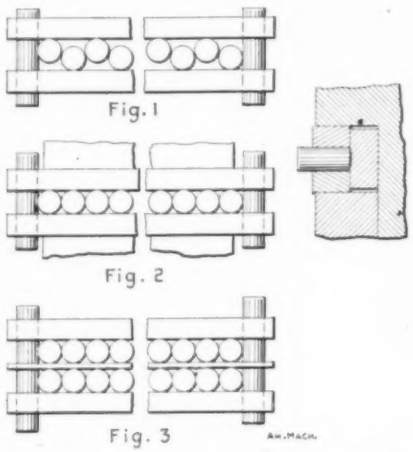
of the stem as at *B* and an oil tube soldered in it. This carried the cutting compound from the hole *F* to the cutter *E*, the compound being forced through the spindle of the tailstock *C*. *D* is a nut used to remove the drill from the spindle.

If the cutter caught in the piece being drilled, the drill was not broken, the stem only was twisted; and this would stand a good deal of twisting before being put out of commission. We have made these drills in several sizes and found them satisfactory.

Dexter, Me. E. W. TATE.

Holding Cylindrical Pieces in the Miller or Planer Vise

I noticed the jig shown in Vol. 35, page 1038. Sometimes the number of pieces required is too small to allow the making of a jig. Nine years ago a job came my



HOLDING CYLINDRICAL PIECES IN MILLER OR PLANER VISE

way that required slots and flats to be milled on 24 plugs ½x1½ inches long. I discovered a way of holding them which appeared in Vol. 25, page 1760. Perhaps its description would bear repeating now.

Using the vise of the miller, the required apparatus consisted of two pieces of flat, cold-rolled steel, each with two drilled holes and two stubs steel pins a working fit in the $\frac{7}{16}$-inch holes. The distance between the pins may be an exact multiple of the diameter of the plugs or shims may be used to make up the difference.

The effect is shown in Fig. 1; the vise is opened a little to receive the plugs. In Fig. 2 the vise is closed, forcing the plugs in a straight line and holding them in a normal position. In any other position they would require more room. The arrangement, Fig. 3, provides for two rows of plugs.

J. SCHURING.

Highbridge, N. J.

Checking Drawings

Referring to the "Method for Checking Drawings," Vol. 36, page 54, submitted by M. R. Kavanagh, I inclose herewith a similar set of rules, which I compiled for the use of our office, and which seems to me to give a rather more logical and comprehensive system for general use.

Most of the queries by Mr. Kavanagh under "Checking Assemblies" should have been thoroughly threshed out and determined before the drawing gets to the checker, although they form a very good guide for the leading draftsman and the chief draftsman in going over the work before putting it in the hands of the detailer and tracer.

While I am always ready to entertain any suggestions from the checker of improvements in the design, I do not particularly encourage his consideration of such matters since, as already stated, they are understood to have been thoroughly considered and determined by competent authority before the drawing reaches him. In cases where I consider the man who is to do the checking particularly competent to pass on the general design, or any particular phase of it, I give him special instructions to do so.

RULES FOR CHECKING

Accuracy, which is the essential requirement for satisfactory checking, can only be attained by following a systematic method. The rules given below must be carefully observed in checking and drawing:

1. Check the scale. Measure up all the principal dimensions and underscore with pencil all which do not scale correctly.

2. Check to the original information. Get out all the detail drawings or sketches used as a basis for the drawing under consideration and check off all the dimensions which check with the original or are correctly derived therefrom.

3. Check the summations. Check all summing dimensions by adding the components.

4. Check for completeness. Are any dimensions lacking which will be needed in constructing the work and are sufficient views and cross-sections given to show the construction clearly?

5. Check for finish. See that finish is clearly called for whenever machine operations are required.

6. Check the bill. See that distinctive names are given to the various pieces and that the number of pieces and material are specified.

7. Check the operation. See whether the machine part in question will perform the operations expected of it and without interference with other parts.

8. Check the title. It should be descriptive of the contents of the drawing and should refer to the job, machine number, etc.

9. Refer back to the man who made the drawing. Explain all the corrections and find out reasons for departures from correct scale or from the original sketches or details. In case of the slightest uncertainty, refer to the chief draftsman. Take nothing for granted.

10. After corrections are made, go over them carefully before pencil notes are erased to be sure all changes are correctly made.

REMEMBER: That following these rules to the letter casts no imputation on the men who made the drawing. It is to the interest of all concerned—his, your own and your employer's—that every mistake be eliminated, so far as possible, before the drawing is issued from the drawing office.

Pottsville, Penn. R. A. WRIGHT.

Method of Making Taps

In Vol. 35, page 759, Mr. Scribner illustrates a die holder with dies for use in making machine-screw tops.

The article gives the impression that the tap manufacturers could not produce taps to as close a limit as desired, and that the dies and holder were considered the best way to make them. That the readers may not get the wrong impression regarding these dies and holder, it may not be out of place at this time to state why they were adopted.

About eight years ago taps were being made by the apprentice boys in one division of the tool department. One day the general foreman asked me to try out one of the dies then in use and find out, if possible, why it would not work satisfactorily. This die was of the two-piece type, and upon close inspection I found it had gone out of shape in hardening, and owing to its peculiar construction, could not be ground to correct the error.

In making my report to the foreman, I suggested trying the round dies, as they were cheaper to make, would be less likely to change in hardening, and that by using three in a holder it would save handling, and, therefore, cheapen the cost of production. At the same time better threads could be produced, for the reason that one die was used for the finishing cut only, where with the old style all three cuts were made with the same die.

As previously stated, this was several years ago, and the round die was, so to speak, in universal use, while now the more progressive factory managers are awakening to the fact that the two- or four-piece die, if properly designed and accurately made, is much better than the round die for general use, especially upon screw machines, where it is necessary to produce the most accurate threaded parts at a minimum cost. However, the round dies at that time, for the purpose in question, gave good results.

As regards ability to purchase taps from the regular tap makers, the firm ordered from several tap manufacturers a quantity of No. 10-24 taps, and while the various makes were not the same in pitch diameter, they were not as large on the pitch diameter as this firm's tap, although the outside diameters in each case were within reasonable limits of each other.

The reason for this was that the firm in question was using No. 10 wire, cutting approximately a U. S. form of thread and fitting the tap to its old master template gage, while the ones they purchased had the so called V-form of thread. Naturally this firm considered its tap to be correct, and, therefore, laid all blame on the tap maker.

Since that time they have gone to the bottom of the thread troubles and established limits on the outside diameter, pitch diameter and angle and pitch. They now buy taps from several makers, obtaining results as satisfactory as when buying milling cutters, drills, etc.

GEORGE H. DAVIS.

New York, N. Y.

Wire Rope Reel Chart

Referring to Mr. Spangler's Wire-Rope Reel Chart, Vol. 36, page 69, it occurs to me that it is necessary to have a different size drum in each reel for each length of rope.

By the use of the formula given below, I have compiled a table of sizes for any length of rope and at the same time requiring only two different size drums. For all sizes up to and including a 4-ft. reel, the drum diameter is 19½ in., and for the larger sizes 31½ inches.

C = Capacity of reel in feet of rope;
W = Width of reel in inches;
D = Diameter of reel in inches;
d_1 = Diameter of reel drum in inches;
d = Diameter of rope in inches.

$$C = \frac{0.0496\, W\, (D^2 - d_1^2)}{d^2}$$

In computing the table, I made individual tables for the values of d^2, $(D^2 - d_1^2)$ and $0.0496\, W$. I then made a final table of values of the numerator and reduced the formula to $\frac{F}{d^2}$ where F equals the entire numerator, F for a 3 ft. 12 in. reel (3 ft. diameter, 12 in. wide) = 546, and for a 3 ft. 14 in. reel equals 636. It will readily be seen that it is an easy matter to compute the capacity of a reel with the above reduced formula.

Trenton, N. J. T. A. SMITH.

Pack-hardening High Speed Steel

In Vol. 36, page 192, is an article on the above subject with the suggestion that this process may be used on metal milling cutters.

About six years ago I had some formed cutters of high-speed steel to harden, also a quantity of screw-machine forming tools. These were all turned or backed off to finish size, then packed in granulated charcoal. Powdered charcoal will not do as a rapid fire of small explosions follow. These were heated to about 1600 to 1700° F. for four to six hours, then cooled in oil. The length of time in the fire was determined by the size of the piece Later I experimented with several makes of high-speed steel and found that "Zenith" was the only one that would harden by this method. Some would become partly hard, others remain soft.

Lately I pack-hardened with bone some blanking dies made of high-speed steel. These were heated to 1700° F. for four hours, quenched in oil, then drawn to 450° F. The results have been very satisfactory. The dies stay in shape there being practically no change whatever, the steel is free from scale and is as hard and seems to do the same amount of work as if heated to the required temperature for high-speed steel.

I am not at liberty to give the name of this steel, as the makers are conducting experiments along this line at the present time.

I have also made some forming dies by this method and find the wearing qualities to be entirely satisfactory.

New York, N. Y. ED. DOBBINS.

Automobile Cylinder Explosion

Having read L. Earle Brown's article, Vol. 36, page 148, on an explosion in the first cylinder of a four-cylinder automobile engine, and, as he desires opinions on the cause, I wish to express mine.

I cannot positively account for it, as I have not seen the machine, but only the photograph. My first thoughts were that nitric acid, which, as you know, contains very high explosive qualities, had been mixed with his gasoline, but as he writes that the remainder was used up without ill effects to the engine, I naturally discarded this idea.

There is, therefore, only one other possible explanation, namely: The exhaust valve refused to work. As this valve is of mechanical action, it stands to reason that some mechanical part, or in other words, some part of the machine which is directly connected with the valve either bent, broke, or jumped out of place, and this part or piece of mechanism could be either the valve lifter or the valve-lifter stem. If either one of these had broken, become bent, jumped out of place or even jammed, the valve would not work. There is also a possibility of the timing gear having slipped out of place, thus stopping the crankshaft from revolving, thus naturally stopping the complete operation of all exhaust valves.

If either of the accidents described happened, then the cylinder head would have to give way before the immense pressure from the accumulation of burnt gases which had no outlet, and the constant ignition of the fresh mixture, which added to that already in the cylinder.

OSCAR KOHSILK.

New York, N. Y.

Assigning Pattern Costs

Referring to the AMERICAN MACHINIST, Vol. 36, page 117, the question is asked: "What do you do with your pattern cost?" We do not see why this should be a difficult question to answer.

We consider the patterns used for our regular product just as we would a jig or any other special tool to build that product. Our patterns for regular equipment are carried in the pattern account and treated as regular equipment, or investment, subject to usual depreciation. The repair of patterns, however, is carried as an overhead account and is kept separate, to know just exactly what this expense is.

The cost of patterns, or alterations of patterns for special jobs, is charged to the job for which the alteration of the pattern is made, even though the pattern may be saved and put in the pattern safe.

W. H. SNOOK,
Supt., Decatur Motor Car Co.

Decatur, Ind.

Boring Holes on the Miller

The article by Mr. Goodrich, in Vol. 35, page 918, tells of one of the best improvements that has appeared in some time.

It seems to me, however, that the plugs might be at right angles instead of parallel to each other. This would make measuring over them about the same as measuring over a flat piece of stock, whose faces are parallel. It would only be necessary to turn the thimble of the micrometer until the anvil and spindle faces were flat against the crossed plugs.

Theoretically these faces touch a line on the surface of each plug. These lines are at right angles to one another, and so each will prevent the micrometer from swinging about the other as an axis, as is done when feeling for the distance over two *parallel* plugs.

JOHN C. TONKIN.

Durham, N. H.

Measuring Nut Threads

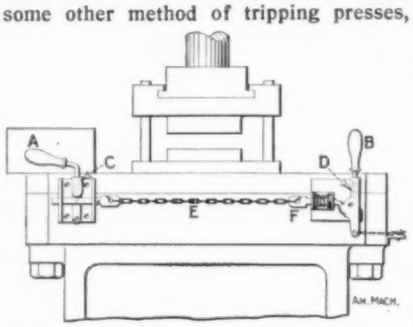
Referring to your paragraph in Vol. 35, page 107: As most nut threads have a barb which makes them more easily screwed on than off, it is well to observe two precautions in casting a screw plug. First, dust the nut thread well with graphite before casting; second, use a square steel core long enough to enable you to screw the plug clear through and out, instead of backing it out. Both precautions at once won't hurt.

ROBERT GRIMSHAW.

Dresden, Germany.

A Tripping Device for Punch Press

In Vol. 35, page 1167, of the AMERICAN MACHINIST, F. O. Green suggests that the foot treadle for operating punch presses be done away with. I believe with him that should it become compulsory to adopt some other method of tripping presses,



A TRIPPING DEVICE FOR PUNCH PRESSES

especially for forming, drawing, perforating, or shearing, where the hands of operators are continually exposed, it would be a long step toward the prevention of accidents in the punch-press department.

W. H. Flynn writes in Vol. 36, page 111, that his experience has been that presses equipped with two-handed tripping devices have decreased in working output. This may be the case with the majority of devices, but I have had an inclinable press so equipped, in continuous operation for some months, and the tendency has been rather to increase than decrease the output.

The diagram shows the device attached to the press. It can be fitted to any style press, wide or narrow. The handles *A* and *B* are for operating and can be readily removed from levers *C* and *D*, to allow clearance for handling the different sizes of bolster plates. Chain *E* allows adjustment for wear and fitting to any width of press. *F* and *D* are ratchet lever and catch, which automatically lock the press against tripping, and must be released by both hands, thus making it impossible for the operator to have either hand in danger and trip the press. The left-hand lever *A* is bent over and allowed to swing freely back and forth, so that the left hand releases the lock and picks up the work with one movement. This, I believe, is the most important factor in upholding the output of the press.

The men prefer this press to others equipped with foot treadle for the reason that they can sit more comfortably at the press and turn out just as much work. Our work is turned out entirely on the piece-work system, and anything that retards speed or otherwise cuts down the men's wages, is quickly objected to.

We have tried out numerous so called safety devices, but find that they will not stand the racket of rapid and continuous operation, such as we give a machine: eventually such devices become loose and a menace rather than a safeguard.

Detroit, Mich. F. W. BOOTH.

Gaging Surfaces by Electrical Contact

An article appeared in Vol. 35, page 1079, under the above heading, describing a surface gage with an electrical device fitted, consisting of a battery and galvanometer to show when contact was made by the feeler point of the gage.

We have used here for some years now an electrical means of setting the depths of cuts on work where the ordinary means of touching the work with the cutter and then feeding in so much, was not accurate enough.

It consisted of a battery giving about four volts, and a buzzer. It was possible to look at the work and hear when the cutter was touching. It seems to me however, that a buzzer would be better in the surface gage, as it would not then be necessary to take the eye off the feeler point.

The work on which this device was used was of circular form and each piece had to be set true, even though the outsides were ground to 0.001 in. limit. Originally a dial indicator was used but with the buzzer and a micrometer head fixed to the machines it is now possible to set each piece true within 0.00025 in.

Of course, special arrangements were made in building the machines to insulate different parts. The Linotype Co. of Manchester, England, uses a microphone on its machines for engraving type punches. It is claimed for this arrangement that the operator can tell to a thirty-thousandth of an inch when he is touching the work with the cutter. Not only that, but he can listen to the operation of the cutter through the microphone and is able to tell when it is getting dull or is not cutting cleanly.

C. A. COPPACK.

Leicester, England.

Indicator for Triangular Scale

The article by H. M. Nichols in Vol. 35, page 1128, under the above heading is, in principle, very nice, but I should like to ask what happens if the diamond-shaped pointer accidentally becomes shifted around to another corner—a thing quite possible with only a central thumb-tack?

Would it not be better if each scale were stained, all the way along or on the end only, a different color? The result would be the same without the risk.

DRAFTSMAN.

Clyde Circus, England.

Standard Flanged Fittings

The following schedules of standard weight and extra heavy flange fittings were adopted as "the 1912 U. S. Standard" by a joint committee of the National Association of Master Steam and Hot Water Fitters and the American Society of Mechanical Engineers.

EXPANATORY NOTES FOR "THE 1912 U. S. STANDARD"

Schedule of standard weight and extra heavy flanged fittings:

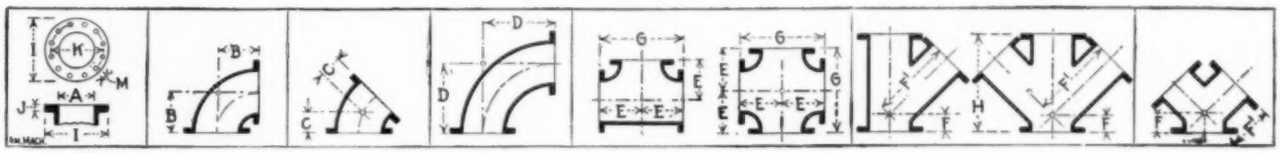
1. Standard or extra heavy reducing elbows carry same dimensions center to face as regular elbows of largest straight size.

2. Standard or extra heavy tees, crosses and laterals, reducing on run, carry same dimensions face to face as largest straight size.

3. If flanged fittings for lower working pressures than 125 lb. are made, they shall conform in all dimensions, except thickness of shell, to this standard, and shall have the guaranteed working pressure cast on each fitting. Flanges for these fittings must be standard dimensions.

4. Where long-turn fittings are specified, it has reference only to elbows, which are made in two center to face dimensions, to be known as "elbows" and "longturn" elbows, the latter being used only when so specified.

5. All standard weight fittings must be guaranteed for 125 lb. and extra heavy fittings for 250 lb. working pressure, and each fitting must have some mark cast on it indicating the maker and guaranteed working steam pressure.



Dimensions Common to all | Elbow | 45-deg. elbow | Long turn elbow | Tee | Cross | Lateral or Y-branch | Double lateral or Y-branch | Y

A	B	C	D	E	F & F'	G	H	I	J	K	L	M
1	3½	2	5½	3½	2 & 6*	7	8	4	7/16	3	4	⅝
1¼	3¾	2	6	3¾	2¼ & 6¼	7½	8½	4½	7/16	3⅜	4	⅝
1½	4	2¼	6½	4	2⅜ & 6⅜	8	9	5	7/16	3⅜	4	⅝
2	4½	2⅝	7	4½	2½ & 8	9	10½	6	½	4	4	¾
2½	5	2¾	7½	5	2½ & 9½	10	12	7	½	5½	4	¾
3	5½	3	8	5½	3 & 10	11	13	7½	½	6	4	¾
3½	6	3½	9	6	3 & 11½	12	14½	8½	½	7	4	¾
4	6½	4	10	6½	3 & 12	13	15	9	½	7½	8	¾
4½	7	4½	11	7	3 & 12	14	15½	9½	½	7½	8	¾
5	7½	4½	12	7½	3½ & 13½	15	17	10	½	10	8	¾
6	8	5	13	8	3½ & 14½	16	18	11	1	9½	8	¾
7	8½	5½	14½	8½	4 & 16½	17	20½	12½	1 1/16	10½	8	¾
8	9	6	16	9	4½ & 17½	18	22	13½	1⅛	11½	8	¾
9	10	6½	18	10	4½ & 19½	20	24	15	1⅛	13½	12	¾
10	11	7	20	11	5 & 20½	22	25½	16	1 3/16	14½	12	1
12	12	7½	22	12	5½ & 24½	24	30	19	1¼	17	12	1
14	14	7½	24	14	6 & 27	28	33	21	1⅜	18¾	12	1¼
15	14½	8	26	14½	6 & 28½	29	34½	22½	1⅜	20	16	1¼
16	15	8	28	15	6½ & 30	30	36½	23½	1⅜	21¼	16	1¼
18	16½	8½	30	16½	7 & 32	33	39	25	1⅜	22¾	16	1½
20	18	9½	32	18	8 & 35	36	43	27½	1⅜	25	20	1½
22	20	10	34	20	8½ & 37½	40	46	29½	1⅜	27½	20	1½
24	22	11	36	22	9 & 40½	44	49½	32	1¼	29½	20	1½
26	23	13	39	23	9½ & 43½	46	53	34½	2	31¼	24	1⅝
28	24	14	42	24	10½ & 46½	48	57	36½	2 1/16	34	28	1⅝
30	25	15	45	25	11 & 49½	50	60½	38½	2⅛	36	28	1⅝

Asterisk (*) indicates center to face dimensions of run on laterals or double laterals, each way. The smaller dimension is also the center to face dimension of a Y on the short end. All other dimensions on Y's are the same as for elbows of the same size. A reducing Y carries same dimensions as a straight size Y of the size of the largest opening in the fitting in question.
All dimensions are in inches.

TABLE I. SCHEDULE OF STANDARD WEIGHT FLANGED FITTINGS

A	B	C	D	E	F & F'	G	H	I	J	K	L	M
1	4¼	2¼	5½	4¼	2¼ & 7¼*	8½	9½	4½	7/16	3½	4	⅝
1¼	4¼	2¼	6	4¼	2¼ & 7¼	9	9½	5	7/16	3½	4	⅝
1½	4½	2¼	6½	4½	2½ & 8½	10	11	6	½	4½	4	¾
2	5	3	7	5	2½ & 9½	11	12	6½	½	5	4	¾
2½	5½	3½	7½	5½	2½ & 10½	12	13	7½	1	5½	4	¾
3	6	3½	8	6	3 & 11½	13	14½	8½	1⅛	6½	8	¾
3½	6½	4	9	6½	3 & 12½	14	15½	9	1⅛	7½	8	¾
4	7	4½	10	7	3 & 13½	15	16½	10	1⅛	7½	8	¾
4½	7½	4½	11	7½	3½ & 14½	16	18	10½	1⅛	8½	8	¾
5	8	5	12	8	3½ & 16	18	19½	11	1⅛	9½	8	¾
6	9	5½	13	9	4 & 17½	19	21½	12½	1 1/16	10½	12	¾
7	9½	5½	14½	9½	4½ & 19	21	23½	14	1 1/16	11¾	12	1
8	10½	6	16	10½	5 & 20½	22	25½	15	1⅛	13	12	1
9	11	6½	18	11	5 & 22½	24	27½	16½	1⅛	14	12	1¼
10	12	7	20	12	5½ & 25½	27	30½	18½	1⅛	15½	16	1¼
12	13½	8	22	13½	6 & 27½	30	33½	20½	1 3/16	17½	16	1¼
14	15	9½	24	15	6½ & 31½	31	37½	23½	1¼	20½	20	1⅜
15	15½	10	26	15½	6½ & 33½	33	39½	25½	1 5/16	21½	20	1⅜
16	16½	10½	28	16½	7½ & 34½	35½	42	26	1⅜	22½	20	1½
18	17½	11	30	17½	8 & 37½	38½	45½	28½	1⅜	24½	24	1½
20	19½	11½	32	19½	8½ & 40½	41	49½	31	1⅜	27	24	1⅝
22	20½	12	34	20½	9½ & 43½	45	53½	33	1⅜	29½	28	1⅝
24	22½	13	36	22½	10 & 47½		57½	36	1⅜	32	28	1⅝

Asterisk (*) indicates center to face dimensions of run on laterals or double laterals, each way. The smaller dimension is also the center to face dimension of a Y on the short end. All other dimensions on Y's are the same as for elbows of the same size. A reducing Y carries same dimensions as a straight size Y of the size of the largest opening in the fitting in question.
All dimensions are in inches.

TABLE II. SCHEDULE OF EXTRA HEAVY FLANGED FITTINGS

6. All extra heavy fittings and flanges to have a raised surface 1/16 in. high inside of bolt holes for gasket.

Standard weight fittings and flanges to be plain faced.

Bolts to be ⅛ in. smaller in diameter than bolt holes.

Bolt holes should straddle center lines.

7. Size of all fittings scheduled indicates inside diameter of ports. For outside diameter pipe use corresponding size of inside diameter fittings.

8. The face to face dimension of a reducer, either straight or eccentric, shall be equal to the diameter of the large flange.

9. Square-head bolts with hexagonal nuts are recommended.

10 Twin ells, double branch ells, side outlet ells, side outlet tees and four-way tees, whether straight sizes or reducing, carry same dimensions center to face and face to face as regular ells and tees.

11. Bull-head tees or tees increasing on outlet will have same center to face and face to face dimensions as a straight fitting of the size of the outlet.

12. Up to and including the 4-in. size, center to face and face to face dimensions of reducing fittings will be the same as that of a straight fitting of the larger opening. (See table for reducing fittings larger than 4 in.).

Steel flanges, fittings and valves are recommended for superheated steam.

KEY TO THE DIMENSIONS GIVEN IN THE TABLES

A = size of pipe line.
B = center to face, elbows.
C = center to face, 45-deg. elbows
D = center to face, long turn elbows
E = center to face, tees and crosses
F and F¹ = center to face, laterals or Y branches
G = face to face, tees and crosses
H = face to face, laterals or Y branches
I = Diameter of flange, all fittings
J = Thickness of flange, all fittings
K = Diameter of bolt circle, all fittings
L = Number of bolt holes, all fittings
M = Diameter of bolt holes, all fittings

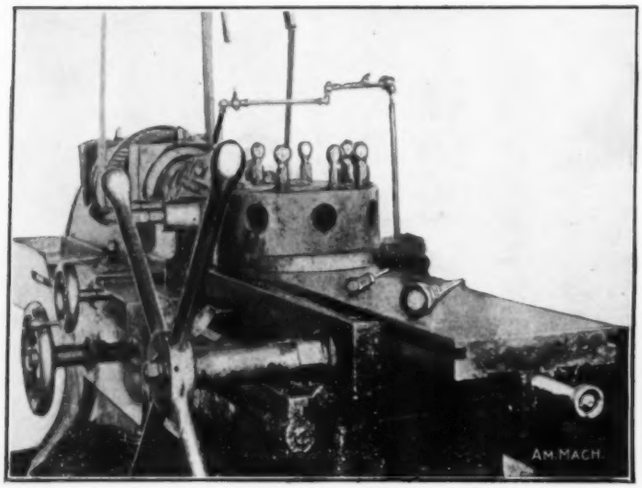
A Large Turret Lathe 40 Years Old

By John J. Grant

Thinking that it would interest readers of the American Machinist, I have secured, through the courtesy of Charles P. Russell, president of the Wiley & Russell Co., Greenfield, Mass., photographs of a turret lathe that I started to build in 1869, and finished in 1871.

Your memory is accurate in regard to the spindle, as we find the hole is 3⅝ in. in diameter. The turret is 12 in. in diameter and there are eight holes in it, each hole 1⅛ in. in diameter. The spindle has a swing 21 in. over the bed. We shall be very much interested to see your description of this machine which you propose to publish in the American Machinist.

The machine shows the general lines of the Pratt & Whitney Co.'s designs of the date this machine was built. I was



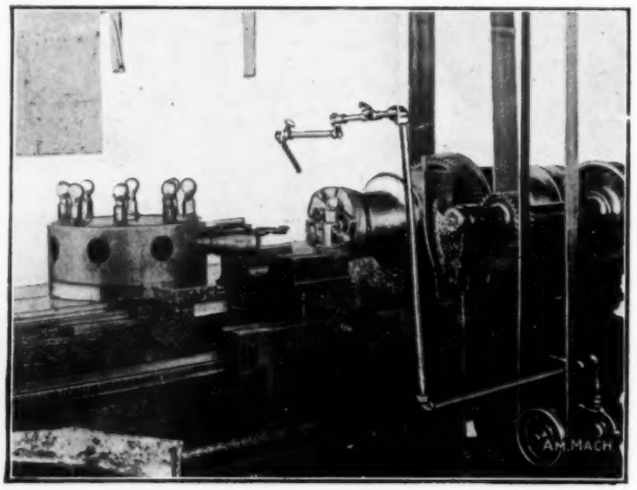


Fig. 1 Turret Lathe 40 Years Old and Still Giving Good Service Fig. 2

Before giving a description of the machine, it will be well to mention the difficulty under which this machine was made. I took the drawings to several machine-tool builders, who either did not want to tackle a machine of that kind or said it would be unwise for me to build a turret machine as large as that. They pronounced it a mechanical monstrosity, said that it certainly would not be a paying investment, as no one would ever turn work from the solid bar over 1½ in. in diameter. Those who knew the late Francis A. Pratt, of the Pratt & Whitney Co., who was at that time noted for his advanced ideas in machine design and construction, will be surprised to know that he tried in every way to dissuade me from making the machine. He finally called me a "damned crank," and said he would not be guilty of taking my money for building such an abortion, and advised me to go home and forget it.

Did I forget it? The illustrations show that I did not, and in 1873, when Mr. Pratt visited me, he saw this machine in operation; it was the means of my becoming associated with his firm. The machine was started in my own small shop and finished after Solon Wiley and Charles P. Russell became associated with me in the tap and die business, in 1871.

The following is from a letter of Mar. 30, 1911, written to me by Mr. Russell:

We are sending you copies of the photographs of the large turret machine which you built here over 40 years ago.

always an admirer of this machinery and naturally drifted into designing my own tools similar to theirs. This machine has many ideas on it that have since been put on machines of its class. I believe it had the first clutch back gear ever put on the headstock of any lathe, as I had a patent allowed on it, which I assigned to the Pratt & Whitney Company.

The machine was designed to make from the bar the dies for the Grant lightning screw-plate and bolt cutters, and is still used for that purpose, as well as many other jobs. It has been in constant use for the past 40 years, and Mr. Russell says it is still in first-class condition, and compares favorably with machines made at the present time.

The dimensions are as follows: Hole through spindle, 3⅝ in.; diameter of turret, 12 in.; number of holes in turret, 8; diameter of holes in turret, 1⅛ in.; swing over bed, 21 in.; swing over carriage, 12 in.; travel of turret slide, 12 in.; weight, about 2500 pounds.

Hot Bearings Sometimes Caused by Electric Currents

By Henry D. Jackson

Not infrequently, bearings are found to heat without any mechanical reason or explanation for so doing, and much time is wasted in scraping, cleaning and realigning without curing the heating. In many of these cases an examination from the electrical viewpoint has shown that the heating is entirely due to the passage of an electric current through the bearings, which though of low potential may be of very great volume, and this current, passing through the resistance offered by the oil, generates heat. This current is itself generated by the stray magnetic fields from cables or from the field magnet of the machine.

This trouble can be corrected by the insertion of insulating material between the pedestal and the foundation plate, care being taken to insulate the bolts as well as the base itself. This insulating material might readily be composed of very thin paper impregnated with shellac or even without impregnation if the voltage is, as is probable, extremely low.

Tests of Cement as an Iron Preservative

Tests are to be made by the Panama Canal Commission, to determine the value of cement mortar applied to iron plates by the "cement gun" as a preservative of iron. Twelve plates, 6⅜x14 in., have been coated with a one to three mortar of cement and sand, after they were cleaned to a gray metal by the sand-blast process. Six of these have been covered with a ½-in. coating, and the remaining six with a 1-in. coat on one side and a 1½-in. coat on the other. Three plates of each kind have been sent to Balboa, and three to Cristobal, where they will be kept immersed in salt water to test the mortar method of preventing corrosion. Two plates of each kind will be taken from the salt water, both at the end of three months, and one-half of the coating will be removed to determine the condition of the metal. The duration of the test for the balance of the plates will be determined later.

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None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 149

American Machinist

Economy in the Power Plant Reduces Overhead Expense

It has long been the saying in a great many shops that the cost of power was hardly worth considering, and it has been a matter of pride in many cases to state the largest amount of power which could be put into a machine tool. This, of course, has been on the assumption that the power consumed was in direct proportion to the work being produced.

This unfortunately is not always the case, but in any event the average machine shop can hardly afford to ignore the cost of its power or its proportion to the overhead expense. In the old days when a 25-horsepower engine would run a fair sized shop, there was far less need of carefully considering the cost of power than at the present time, when this amount is often required to drive a single machine tool.

The main business of a manufacturer's shop being to manufacture its product, and the production of power being an incidental to the main aim, we are very apt to overlook the power-plant end of the business and to allow many small wastes, which might easily be avoided. The manager is apt to give too little attention to the real value of the engineer, and to consider him rather as a necessary evil, a man must be employed to see that the boilers are fired and the engine started, so that the machines may be kept in motion. While these are, of course, his main duties, a good engineer cannot only generate power at a lower cost than a man who does not understand his business, but he is also a guarantee against unnecessary shutdowns, which affect the manufacturing end of the establishment so plainly that it cannot be overlooked.

We do not expect the toolmaker to do good work without a full equipment of all necessary tools, and in the same way the engineer should be supplied with the necessary instruments for measuring his product, power and the means of producing it, so that he can know whether he is securing proper results or not. If we look at him in something the same light as one of the men in the manufacturing end, we can easily see that it is just as necessary to provide him with such tools as an indicator, a recording gage and a gage tester, as it is to give the toolmaker standard measuring blocks, special micrometers and accurate squares.

While there has been much unnecessary use of the steam-engine indicator, the same is also true of the micrometer, and yet there is hardly a question that the judicious use of both has proved profitable, each in its respective field.

We hold no brief for the stationary engineer, but as long as he is a very necessary part of any manufacturing establishment, it certainly seems advisable to give him and his department the same consideration as any other unit of the plant. Any saving which may be made in this department, as to the cost of generating power, is a direct reduction in the overhead expense, and a saving which if continued, keeps this at a lower figure all through the year.

Another Bill for Promoting Industrial Education

At page 177, Vol. 35, we commented on the Page Bill for the appropriation of government funds toward the teaching of industrial trades.

Another bill was recently introduced, by Representative Anderson of Ohio, which aims

to coöperate with the states in encouraging instruction in agriculture, the trades and industries, and home economies in secondary schools; in maintaining instruction in these vocational subjects in state normal schools; in maintaining extension departments in state colleges of agriculture and mechanic arts, and to appropriate money and regulate its expenditure.

Special provision is made for secondary grades, probably with the knowledge that but a small percentage of pupils ever go beyond the grammar grades. This clause follows:

For the maintenance of instruction in the trades and industries, home economics, and agriculture in public schools of secondary grade, the sum of five million dollars, beginning with the fiscal year ending June 30, 1915, and annually thereafter, to be allotted to the states, territories and the District of Columbia in proportion to the population as shall be determined by the census of 1910.

Four million dollars are proposed for instruction in agriculture and home economics in state district agricultural schools of secondary grade with the proviso that

For each state and territory with less than one hundred thousand people engaged in agriculture there is hereby appropriated for these state district agricultural high schools the additional sum of five thousand dollars annually.

The state experiment stations already established are to receive one million dollars annually, with an additional twenty-five hundred dollars under the same conditions as the proviso previously given. No state or territory, however, shall secure its allotment until its legislature shall have provided a sum at least equal to its allotment.

It is expressly provided that no portion of this shall be applied to land or buildings, thus making it available only for purposes of instruction.

These bills are in line with the growing interest in an industrial education which shall decrease the number of boys and girls who drift into the first trade available without regard to their liking or adaptability. And when we consider that the real progress of any nation depends upon the efficiency of its workers in the industries, the price of a single battleship, or less, seems a small price to pay for making the experiment on a large scale.

Suspending the Patent Laws

With a view of preventing trusts being built up by the aid of patents, as has undoubtedly been done in many cases, a bill has been introduced by Representative Campbell which provides in part as follows:

Suspending the patent and copyright laws of the United States when a patent or copyright or any article or product protected by patent or copyright is owned, used or leased by any trust or monopoly in restraint of trade in violation of the act of February 4, 1887.

Regardless of one's personal views in such a matter, when we consider the litigation which has been necessary to determine whether or not a large corporation was a trust or not, the remedy does not seem particularly hopeful. For, assuming that the patent protection be removed, it is more than likely that the large corporation can manufacture the article at a lower cost than any new shop starting in to do so.

True, the price might have to be reduced and at least a portion of the object of the bill attained in this way, but the proposed remedy does not appear to be free from serious drawbacks when the cost of litigation is considered.

Milton P. Higgins

In the death of Milton P. Higgins, of Worcester, Mass., on Mar. 7, American manufacturing lost one of its leaders, and the cause of technical and industrial education one of its strongest supporters.

Mr. Higgins was born in Standish, Me., Dec. 7, 1842, of a Cape Cod family with English ancestry. He was one of a large family on a typical Maine farm. His liking was for mechanical work, however, and, at the age of 17, he entered the shops of the Amoskeag Manufacturing., of Manchester, N. H., as an apprentice. Realizing the desirability of advanced education, he studied evenings, saved his earnings, and later put himself through Dartmouth College, whence he was graduated in 1868 with the degree of Bachelor of Science.

It was characteristic of Mr. Higgins that throughout his life he retained his pride in his trade, thinking more of that than of his college degree, or of any of the many honors that came to him in his later years. To use his own expression he was a "B. I." (Bachelor of Industry).

After graduation, he became a draftsman at the Washburn & Moen Wire Works, in Worcester, under the late C. H. Morgan. It was during this association that he was selected by Mr. Morgan and the other trustees of the Worcester Polytechnic Institute to put into effect the unique idea of a school shop to train students. For 28 years he was superintendent of the Washburn shops of the Institute. He built up several commercial lines of machinery of his own design, including machine tools, grinding apparatus and hydraulic-plunger elevators. The marked success of many of the older graduates of the institute is attributable in no small degree to the atmosphere of commercial industry and thrift that pervaded the shops under his administration.

While busily engaged with the school shop, he was also undertaking other enterprises that his judgment commended. In 1885 he foresaw the possibilities in a little emery-wheel business that was being carried on with indifferent success by the late F. B. Norton. In company with his associate, Professor Alden of the Institute, he took over this business and organized the Norton Emery Wheel Co. The organization then developed has remained intact until now broken by Mr. Higgins' death. The extension of the business, including the founding of the Norton Grinding Co., needs but a word of comment, for its growth and development are known to everyone in machinery-building circles.

In 1889 Mr. Higgins was granted a year's leave of absence from the Worcester Polytechnic Institute, in order that he might organize the shops of the Georgia School of Technology at Atlanta. Later, he planned the shops of the Miller Manual Labor School of Virginia.

MILTON P. HIGGINS

In 1896 the Worcester Polytechnic Institute sold the hydraulic-elevator business to the man who had successfully built it up. Mr. Higgins and his friend Professor Alden resigned from the faculty of the Institute and organized the Plunger Elevator Co., as president and treasurer, respectively. Here they again met with their usual business success.

In 1904 Mr. Higgins picked out another struggling business and reorganized it into the Worcester Pressed Steel Co. Further, he was president of the Manchester Supply Co., Manchester, N. H., of the Sanford Riley Stoker Co., Ltd., Providence, R. I., and a director in the Mechanics National Bank of Worcester. He was a member and former vice-president of the American Society of Mechanical Engineers, and a charter member of the Society for the Promotion of Industrial Education. He was held in high esteem in many social organizations, including the Congregational Church and the Worcester Club. In 1903 he was appointed a trustee of the Worcester Polytechnic Institute, so that his services there were almost continuous for over a period of 43 years.

This brief record of his business achievements might seem to indicate the life of a busy and successful man of affairs, who must have been too much engrossed in his own work to be able to render service for the common good. However, it was perhaps Mr. Higgins' greatest ambition to do his part toward solving the great problem of training boys in the secondary schools for a useful life work. He realized this great need long before the present movement for industrial education took shape. In 1899 he presented before the American Society of Mechanical Engineers a paper, "Education of Machinists, Foremen and Mechanical Engineers," that struck a vital chord.

In his own city, he succeeded in starting a trade school that today stands as a monument to his devotion. He was the first president of its board of trustees, holding this position until his death.

Personally, he was of a genial disposition, democratic to a remarkable degree, and always seeking for information. Anyone whom he questioned realized at once the necessity of getting down to facts and staying there. He was fond of the beautiful and had a wholesome contempt for the trivial and useless. He was never too busy to help the deserving. Many a young man owes his real start in life to the fact that M. P. Higgins saw in him something that no one else did, and opened the way for its expression.

National Metal Trades Association

The fourteenth annual convention of the National Metal Trades Association will be held on April 11, 1912, at the Hotel Astor, New York City.

Heald Machine Co's. New Shop

The formal opening of the Heald Machine Co's new shop in Worcester, Mass., held on the evening of March 7, took the form of a musical entertainment and luncheon for the employees and friends of the company. About 300 people were present.

PERSONAL

James H. Herron, formerly with the Motch & Merryweather Co., and who has conducted a consulting engineer's office in Cleveland, has been appointed permanent secretary of the National Machine Tool Builders' Association. He will probably make his headquarters in Cleveland.

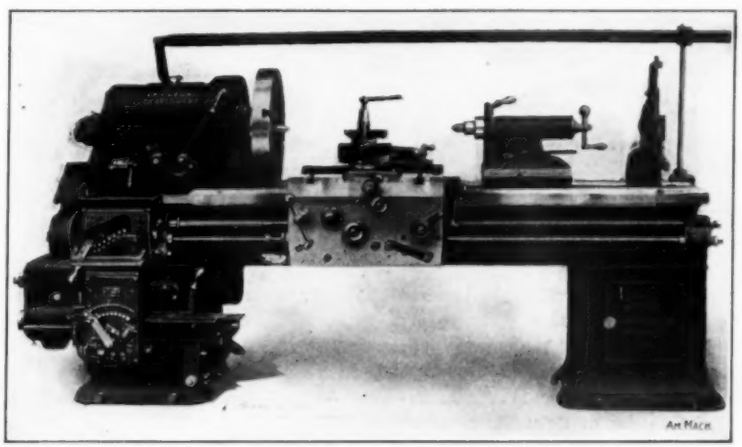
Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Bradford Quick Change Gear Lathe

The motor-driven, heavy pattern lathe shown in the halftone was recently placed on the market by the Bradford Machine Tool Co., Cincinnati, Ohio.

The mechanical speed changes are instantly available and the lathe is stopped, started or reversed by means of a shifter rod readily accessible.



BRADFORD QUICK-CHANGE GEAR LATHE

Incorporated in the drive is a selective type of automobile speed box, furnishing four speeds in itself, and the obtainable revolutions of the lathe spindle are marked on the speed plate for the four positions of the speed-box lever, which in conjunction with the right and left position of the lever on the head gives all the spindle speeds. The speed-box lever is locked automatically when the lathe is running.

The lower gear-box shaft is continued to the left of the gear box, and is in driving connection by means of a pair of gears, as well as by a pair of Morse silent chain wheels with a short countershaft driven direct by a pinion on the end of the motor shaft. Friction-clutch members, to engage either the gear or chain drives, are furnished, and these are in operative connection with the long shifter handle, so that the lathe can be readily run forward or backward, and provide as well a quick brake stop for working up to shoulders. A shot-bolt, in positive operative connection with the main-clutch operating lever, prevents the shifting of the gears under load.

The head has for its first driver a short shaft carrying a Morse chain wheel and a gear wheel, which are in driving connection respectively with a chain wheel on the right-hand end of the upper gear-box shaft and a friction-clutch operated gear on the main spindle, which latter gear is in driving connection with a gear on the back-gear shaft; this back-gear shaft also carries another gear, which is in turn in driving connection back again to the lathe spindle by means of a second positive-clutch operated gear on the spindle. The lever on the head is in operative connection with the friction and positive clutches, which respectively engage the high- and low-speed gears with the spindle. All supplementary speeds are procured through the regulating rheostat shown.

When not in use, the wormwheel on the chasing dial is swung out from the lead screw to an inoperative position by means of a cam and knurled knob. The quick-change gear device is of the regular Bradford type, and gives an unlimited range of feeds. The gear guards, covering all exposed gears on the machine, afford effective protection both to the operator and the machine, and the lathe can also be arranged to be driven by a single pulley instead of with a motor.

Simplex High Speed Hack-saw Blades

The Simplex Tool & Supply Co., Boston, Mass., has recently developed a line of high-speed hack-saw blades made from tungsten steel.

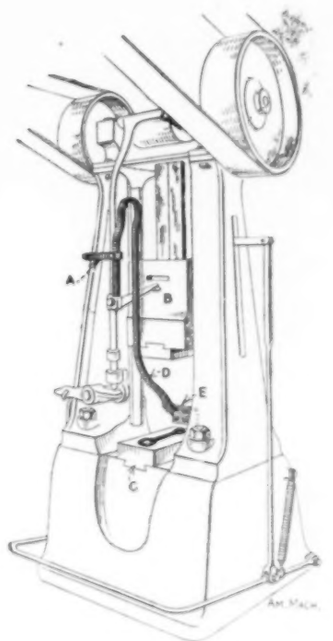
The blades are manufactured in the usual variety of sizes.

A Device to Insure the Safety of Drop Forge Press Operators

The illustration shows a device developed by J. H. Williams & Co., Brooklyn, N. Y., for automatically preventing accidents in drop-forging shops.

Drop forgings which require little machining, are frequently furnished to gage sizes and, therefore, are "restruck" in forging dies after the "flash" or excess of metal has been removed.

Through some disconcerted action, the operator when seating the forgings in the die impression, by hand, meets with serious injury from an untimely fall of the ram. To avoid such accident, the spring-steel device shown in the darker outline of the illustration is clamped to the guide or upright at *A*. When the ram *B* descends, its contact with the device at *D* automatically forces the hand of the operator to a place of safety at *C*; the leather pad *E* modifies the force of the blow to the operator's hand.



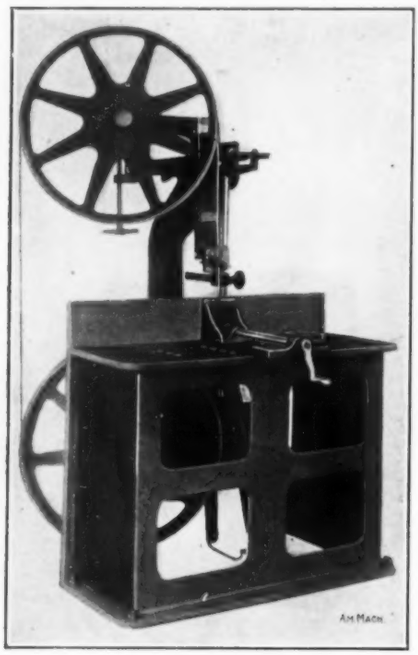
SAFETY DEVICE FOR DROP-FORGING PRESS

The device is very simple in construction and easily applied. Its action is positive and there is very little chance of its getting out of order.

Tilting Metal Band Saw

The tilting metal band saw shown herewith is designed to cut all kinds of metals of various shapes, such as rounds, squares, flats, angles, beams, rails, pipe, tubing, etc.

The saw moves to the metal cutting by gravity feed instead of being forced by weights. The band wheels are set on an



TILTING METAL BAND SAW

angle, which gives a clearance, so that a bar of any length can be cut in the middle. These band wheels are built on a tilting arm, which tilts forward over the table and gives a continuous operation. The saw bands used are only $\frac{1}{16}$ in. in thickness.

The saw is a recent product of Houghton & Richards, 26 North Clinton St., Chicago, Ill.

Automatic Stay-Bolt Driller

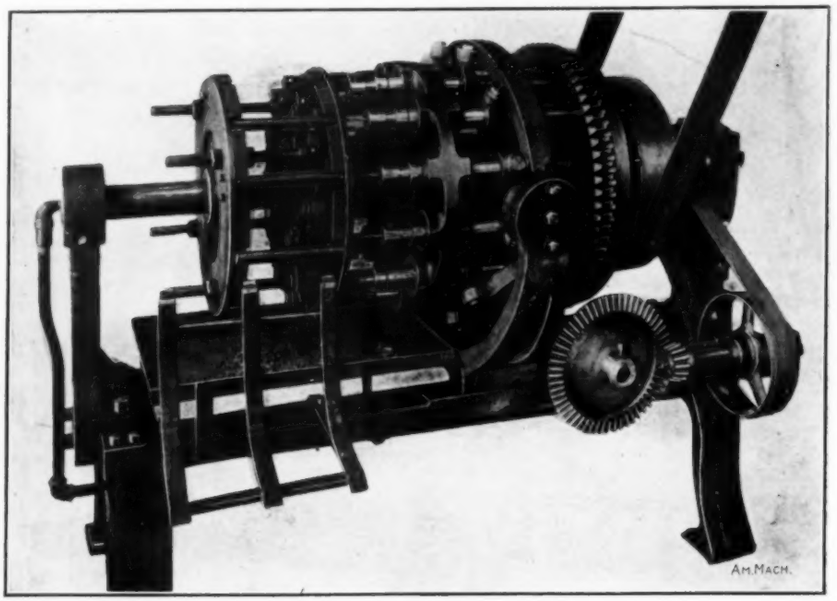
The Richmond Stay-Bolt Drilling Machine Manufacturing Co., 11 East Broad St., Richmond, Va., is manufacturing the recently invented stay-bolt driller shown in the illustration. It is automatic in everything except the feeding.

Originally it was intended to feed the stay-bolts from a hopper, but a boy has been found more satisfactory in practice. The stay-bolts are dropped into slots in the revolving carrier and are locked in by cam-operated fingers.

The driller head carrying the spindles, revolves with the bolt carrier and after a stay-bolt is locked in by its locking finger, the drill spindle opposite it is fed in by a cam, and as the drill is withdrawn, the stay-bolt is released and drops out.

The driller head and carrier are revolved by means of a worm and worm gear, through bevel gears belted to the driving spindle. The drill spindles are run by a large gear on the main pulley shaft, which meshes with a small gear on each spindle.

Ample means are provided for carrying lubricant to the drills while actually drilling. Adjustment of the carrier may be easily made to accommodate different lengths of stay-bolts.



AUTOMATIC STAY-BOLT DRILLING MACHINE

Adjustable Drawing Table Bracket

The design of this drawing-board bracket is apparent from the illustration and requires very little explanation.

ADJUSTABLE DRAWING-BOARD BRACKET

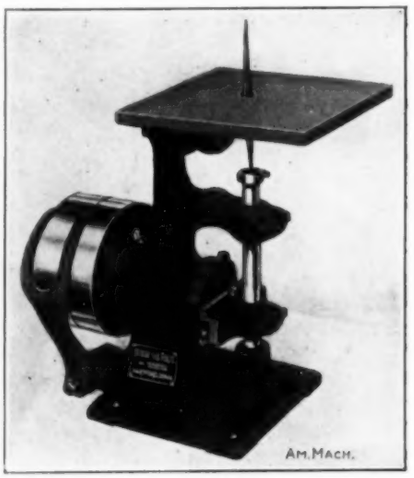
It has universal adjustment and is locked in position by specially designed clamps.

The bracket is a recent development of the American Drafting Furniture Co., Rochester, N. Y.

Bench Filer

The machine shown has long shaft bearings, adjustment for wear, and all of the working parts are protected from the file by a cover, not shown in the halftone.

As will be noted, the machine has a square table, which can be tilted in four directions or in four combinations of two angles out of horizontal. The stroke is adjustable from dead center up to 2 in., and is changed by loosening one setscrew and rotating the wristpin cam. Ordinary files are used.

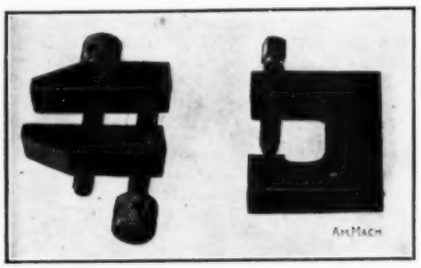


BENCH FILER

This filer is a recent product of the Robinson Tool Works, Hartford, Conn.

Machinist's C and Parallel Clamp

The halftone shows a line of clamps made by the Worcester Trade School, Worcester, Mass. The C-clamps are made in six sizes from 1 to 4 in. inclusive.



MACHINISTS' CLAMPS

The parallel clamps are made in four sizes, from 1¼ to 4 in. inclusive. The larger sizes are provided with a pin for tightening the screws. The clamp has a knurled head and fits a hole drilled endways in one of the jaws, where it is kept when not in use.

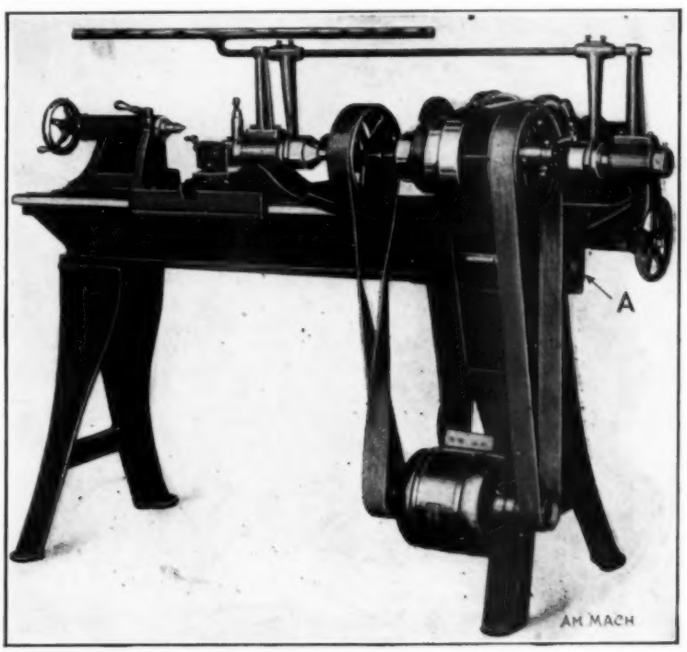
These tools are made of machine steel case-hardened and have case-hardened screws.

Double Belt Reversible Motor Drive

The halftone shows a lathe equipped with the O'Brien doublt-belt, reversible motor drive recently developed by the South Bend Machine Tool Co., South Bend, Ind.

A cast-iron bracket, carrying both countershaft and motor, is pivoted to a casting attached to the lathe bed, as shown at *A*. This bracket is adjustable as a belt tightener between the countershaft and spindle cones. Adjustment is made from a screw in front of the lathe, which enables the belt to be tightened while the lathe is running. The belts from the motor to the countershaft are tightened by a simple adjustment on the base of the motor.

As the countershaft, complete, is attached to a pivoted bracket, the starting, stopping and reversing of the lathe, and the variation of the speed, are obtained through the countershaft in the regular way. Control of the lathe is through the horizontal shipping bar shown. The length of the belt from the countershaft cone to the spindle cone is 48 in.

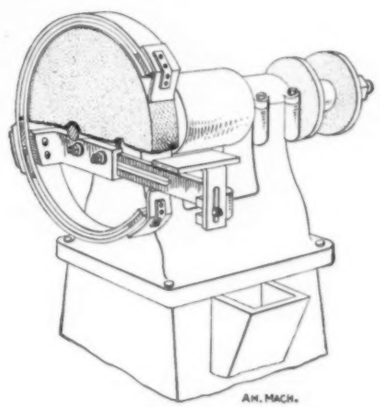


DOUBLE-BELT REVERSIBLE MOTOR DRIVE

Emery Wheel Guard

The design of this guard is made clear by the illustration.

It consists of a heavy arm to bolt to the machine, and four heavy steel bands, two at the bottom and two at the top, with ends secured to heavy steel blocks and bolted to the arm. The device is thereby of heavy construction, but avoids rigidity.



EMERY-WHEEL GUARD

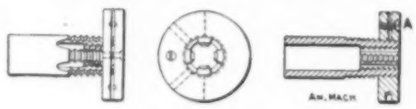
At the ends are angle plates to hold in position the shields arranged to follow the wear of the wheel, the lower shield serving to deflect the grinding from the wheel while the upper shield protects the eyes of the workman.

This guard is a recent development of the Challenge Machine Co., Philadelphia, Penn.

Spring Die

The special feature of the spring die shown herewith is readily apparent from the illustration.

The sectional view shows the method of adjustment. The body of the die has a taper thread cut on its periphery and a corresponding taper thread in the adjusting collar. The latter is locked by the binding screw shown at *A*.



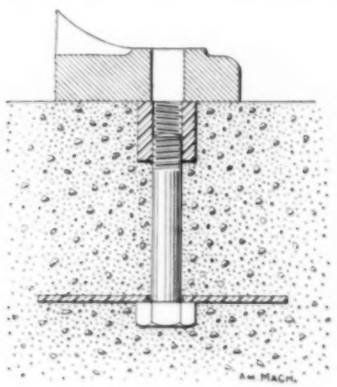
SPRING DIE

The die is a recent development of G. W. Hird, Dunellen, N. J.

Danger of Projecting Studs

BY E. A. BATTELL

It has been my experience that when it is necessary to bolt machinery or timbers to concrete, projecting studs are a nuisance. Several times I have had narrow escapes from pitching headlong; this was caused by the sharp corners or spurs of the projecting studs catching in my overalls.



THE IMPROVED STUD

To obviate this difficulty I use a nut of double length screwed half way onto the bolt in the concrete and let it flush, as shown. This permits the use of studs of any required length.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

Frank C. Rawson, 134 West Boylston St., Worcester, Mass., manufacturer of edge-tool handles, etc., will remove to Keene, N. H., and will enlarge his plant.

The Majestic Manufacturing Co., Worcester, Mass., manufacturer of motor-cycle side cars, will double the capacity of its plant. Dynamos for motive power will be installed.

Holyoke, Mass., will issue bonds for $156,000 for improvements of its water system and its gas and electric-light plant.

Three boilers and four turbine generators will be installed in the municipal electric-light plant, at Chicopee, Mass.

The Metz Co., Waltham, Mass., manufacturer of automobiles, has broken ground for a new factory building. It will be three stories high, of concrete and brick construction.

The Millers Falls Co. will build an addition to its tool plant, at Millers' Falls, Mass.

E. A. Dexter will erect a new bakery and garage, on Bond St., Springfield, Mass. The bakery is to be 100x114 ft., three stories and basement, built of brick, mill construction, with Ohio sandstone trim, concrete flooring, steel beams, steam heat, elevator, etc. The garage will be 66x112 ft., one story high, built of brick, with steel beams and girders and a tar and gravel roof. Samuel M. Green, Inc., is the architect.

Plans are being prepared for a rolling mill which the Worcester Pressed Steel Co. contemplates erecting at Greendale, Mass. It will be frame, about 100x200 ft., two stories high.

Victor E. Menard, Holyoke, Mass., is having plans prepared for a four-story brick garage, to be built on Division St.

The Sawyer Down Draft Manufacturing Co. will erect a plant, at Mansfield, Mass. The company will manufacture a new type of water heater.

The Brightwood Motor Manufacturing Co., Springfield, Mass., contemplates absorbing the plant of the Springfield Metal Body Co., with a reorganization of the business of the two companies. Enlargement of the metal-body plant is contemplated.

The plant of A. J. Vester, manufacturer of gas and electric fixtures, Calender St., Providence, R. I., was damaged by fire. Loss, $20,000.

The city of Woonsocket, R. I., contemplates the expenditure of $25,000 on a new storage water tank. A. F. Ballou is superintendent of water-works.

The Metallic Shell & Tube Co., will establish a plant, at East Providence, R. I., for the manufacture of seamless tubes and railroad torpedoes.

The Atterbury Motor Truck Co., Meriden, Conn., will open a service station, at Hoodley Pl., Hartford, Conn.

The Twin Blade Safety Razor Co. is to remove its plant from Waltham, Mass., to New Haven, Conn. Chas. E. Graham, of West Haven, Conn., is president.

A contract has been awarded by the Waterbury Brass Co. for constructing an addition to the plant, at Waterbury, Conn. The building will be 150x70 ft., of brick, steel frame, with a concrete roof.

A. C. Swan & Co., Norwich, Conn., will construct a one-story brick garage, on Main St., New London, Conn.

The Abbott Ball Co., 14 Hicks St., Hartford, Conn., manufacturer of steel balls, will build a new factory at Elmwood, a suburb. The building will be 40x100 ft., two stories high, and of brick, steel and concrete construction.

G. L. Hammond, Woonsocket, R. I., is general manager of a new concern which will erect a factory in Bridgeport, Conn., to manufacture linotype machines.

The Risdon Tool & Machine Co., makers of dies, small machines and tools, 63 Canal St., Waterbury, Conn., is preparing to move its factory to Naugatuck.

MIDDLE ATLANTIC STATES

L. C. Smith & Bros. Typewriter Co., Syracuse, N. Y., has practically completed its new building and has begun the installation of machinery.

The Syracuse Ornamental Co., Clinton St., Syracuse, N. Y., manufacturer of coffin trimmings, will build a new shop.

The Crouse-Hinds Co., Syracuse, N. Y., manufacturer of electrical appliances, has built a new plant, on Wolf St., and will install machinery.

Plans have been completed for an addition to the plant of the Hooker Electro-Chemical Co., at Buffalo Ave. and the Niagara Junction Ry., Niagara Falls, N. Y.

The Automatic Stucco Machine Co., Portchester, N. Y., recently incorporated, will build a plant to manufacture stucco machines. Noted Mar. 7.

The Board of Water Supply, 165 Broadway, New York, will receive bids until 11 a.m., Mar. 26, for furnishing and delivering bronze ladders, steel gratings, wrought-iron pipe railings and steel plates for the upper gate-chamber of Ashokan Reservoir, at Brown's Station, Olive, N. Y.

The Pierce, Butler & Pierce Co., makers of heating supplies, will build a three-story and basement addition to their plant at Eastwood, N. Y. It will be 50x110 ft., of brick and steel construction.

The Mackay Manufacturing Co., 234 Water St., after May 1, temporarily located at 94 Beekman St., New York, N. Y., has purchased the plant of the New Jersey & West Virginia Bridge Co., at Manasquan, N. J., and will take possession after Apr. 1. The plant will be used for the manufacture of boilers. Little work will be done this year, except making iron patterns. An additional five acres have been purchased adjoining, and it is the intention of the company to be used at a later date as a radiator foundry. All machinery will be purchased by J. M. Mackay, of the above address.

The contract for constructing a water-supply system for the Manhasset-Lakeville Water District, has been awarded to W. G. Fritz, Dover, N. J., at $114,189.

The Goeller Iron Works, Waverly, Newark, N. J., is erecting a one-story addition to its plant on Frelinghuysen Ave. The building will be 100x200 ft., of steel and corrugated iron construction, and will be used for a light structural workshop.

The Fishback Motor Co., Newark, N. J., capitalized at $2,000,000, contemplates locating at Bristol, R. I.

The Diamond Forging & Manufacturing Co., Chartiers St. and Ridge Ave., Pittsburg, Penn., whose buildings were destroyed by fire, Feb. 21, announce that plans for rebuilding are being prepared. New equipment will be purchased at once.

The Pittsburgh Steel Co., Frick Building, Pittsburg, Penn., is planning to erect two blast furnaces and several openhearth furnaces, at its main plant, at Monessen, Penn.

The Greenville Metal Products Co., Greenville, Penn., maker of automobile parts, will manufacture automobiles. New equipment will be required.

Construction work will start about Apr. 1 on a malleable-iron foundry, to be erected at the plant of the General Electric Co., Erie, Penn. The contract for the steel work has been awarded to the Riter-Conley Manufacturing Co., 55 Water St., Pittsburg.

The Chester County Electric Co., Avondale, Penn., is considering the installation of new machinery. R. B. Rhodes is general manager.

Plans for improvements to the Edgar Thomson plant of the Carnegie Steel Co., at Braddock, Penn., are being prepared. Estimated cost, $6,500,000. The plans include openhearth steel works and new rail mills.

The C. H. Wheeler Manufacturing Co., manufacturer of water-cooling apparatus, Lehigh Ave. and 18th St., Philadelphia, Penn., has purchased a lot, 400x150 ft., adjoining its Sedgley Ave. property, upon which to erect a new machine shop. New machinery and equipment will be needed.

M. Nidlinger, architect, Diamond Bank Building, Pittsburg, Penn., is receiving bids for the construction of a six-story factory for the Scientific Material Co., 717 Forber St.

The American Ax & Tool Co. will move from East Douglass, Mass., to Glassport, Penn. The capacity of the plant will be doubled.

The Neville Iron Co., Curry Building, Pittsburg, Penn., has purchased a six-acre tract on Neville Island. A furnace is to be erected and electric cranes and lifting magnets will be installed. A railroad siding is to be constructed to connect with the Pennsylvania R.R.

The Kline Kar Motor Co., Pittsburg, Penn., is asking bids for the erection of a one-story and basement brick and terra cotta garage and show room. C. P. Hitchens, 413 Kingsboro St., is the architect.

Plans are being prepared by the Pennsylvania R.R. Co. for extensions to its repair shops, at Pitcairn, Penn. The improvement will include a new power house. A. W. Gibbs, Philadelphia, is chief mechanical engineer.

The Westinghouse Electric & Manufacturing Co., Union Bank Building, Pittsburg, will install an eight-wheel, radial truck, steam locomotive crane, with a lifting capacity of 15 tons. The locomotive is to be equipped to burn fuel-oil.

Smith & Lewis, engineers, Oliver Building, Pittsburg, have awarded contracts for equipment for the new plant of the Cross Creek Coal Co., at Burgettstown, Penn.

The American Can Co., Fourteenth St. and Tenth Ave., New York, N. Y., will build a two-story addition to its plant on Luzerne St., between Hudson and Boston Sts., Baltimore, Md. The building will be 32x100 ft.

The Western Maryland Ry. Co. will erect a new machine shop, in Hagerstown, Md. W. J. Bingley, Hagerstown, is master mechanic.

A new machine shop will be built at the shops of the Baltimore & Ohio R.R., at Mount Clare, Md., to replace that destroyed by fire. J. W. G. Brewer, Mount Clare, is assistant master mechanic.

The Isthmian Canal Commission, F. C. Boggs, Major, Corps Engineers, U. S. A., Purchasing Agent, Washington, D. C., will receive bids until 10.30 a.m., Mar. 28, for materials on Circular 687, as follows: 250 bars steel, cold-rolled, round, 14 to 16 in. (for machinery stock); medium-steel bolts; to have 5 ft. 6 in. of thread on one end and 6 in. of thread on the other; to have square nuts; to have no welds; 30 push cars, 5-ft. gage; 1050 ft. 1½-in. metallic steam hose; 2050 ft. 1½-in. wire wound steam hose.

SOUTHERN STATES

The Wilmington Iron Works, Wilmington, N. C., will soon be in the market for a 30-in. lathe, a miller and a shaper.

John Rourke & Sons, iron works, Bay and East Broad Sts., Savannah, Ga., are planning a 60x80-ft. machine shop. They expect to have this finished within 90 days and will need an 18-in. and a 36-in. lathe and a slotter.

The garage of William Summers, on South Main St., Gainesville, Ga., was dmaged by fire, Feb. 28. Loss, $2000. Covered by insurance.

The Seminole Power & Ice Co., Fort Myers, Fla., is considering the installation of an electric-generating unit at its plant. R. B. Reynolds is superintendent.

Bids will be received by Clarke S. Smith, U. S. Engineer Office, Mississippi River Commission, First and Second Districts, Memphis, Tenn., until noon, Mar. 26, for furnishing turbines, pumping sets, boilers and an electric-light plant.

The Louisville & Nashville R.R. Co. will construct new shops at Winchester, Ky. C. F. Giles, Louisville, is superintending machinist.

MIDDLE WEST

Plans and specifications have been prepared for two new buildings at the Toledo & Ohio Central Ry. shops at Bucyrus, Ohio, to be built at a cost of $30,000. J. T. Luscombe, Bucyrus, is division master mechanic.

Plans and specifications are being prepared for extensive improvements to the plant of the Ohio Steel Finishing Co., in South Lima, Ohio.

The Conover & Overkamp Machine & Tool Co., Dayton, Ohio, has been incorporated with a capital stock of $65,000. The company will take over the plant of the Miami Valley Machine & Tool Co. The company will require new machine tools.

The Cincinnati Car Co., Spring Grove and Mitchell Aves., Cincinnati, Ohio, is building an addition to its plant. Equipment will be installed for the manufacture of all-steel cars.

The Alvey-Ferguson Co., manufacturer of conveying machinery, North Ave., Oakley, Ohio, will soon ask bids for the construction of a power plant at Oakley, according to plans prepared by the Allyn Engineering Co., Cincinnati. The plant will be 37x70 ft., with steel frames and stucco walls. Two 150-hp. boilers will be installed. The company expects to construct a three-story addition, 80x180 ft., during the summer.

The Owens Bottle Machine Co., Nicholas Building, Toledo, Ohio, whose plant was destroyed by fire, Mar. 2, at a loss of $100,000, will rebuild.

The Ohio Steel Foundry Co. will improve its plant and build a pattern storage house, at Lima, Ohio.

Fire destroyed the finishing department of the Wickham Piano Plate Manufacturing Co., Springfield, Ohio. Estimated loss, $15,000.

The Overland Automobile Co. has awarded the general contract for a four-story and basement factory, 40x60 ft., at Central and Yost Sts., Toledo, Ohio. Cost, $30,000. J. N. Willys is president.

The Ferro Machine & Foundry Co., East Sixty-sixth and Hubbard Sts., Cleveland, Ohio, is considering plans for the construction of a new foundry and machine shop, costing $100,000. B. McGeorge is engineer for the company.

The Atlas Car Manufacturing Co., 1289 Marquette Road, Cleveland, Ohio, is having plans prepared for the construction of a new factory. It will be two stories high, 74x400 ft.

The Oakwood St. Ry. Co., Brown and Fairground Aves., Dayton, Ohio, is having plans prepared by Albert Pritzinger, 1125 Reibold Building, for the construction of a new two-story machine shop to cost $50,000.

The John B. Fey Co., maker of physicians' and hospital apparatus, has moved its plant from Akron, Ohio, to 208-310 Walnut St., Cincinnati.

Plans are being prepared by Walker & Weeks, architects, 1900 Euclid Ave., Cleveland, for the construction of a factory for the Automatic Sprinkler Co., at Akron, Ohio. It will be 235x400 ft., one story high.

The Moore Motor Truck Manufacturing Co., Toledo, Ohio, has increased its capital to $200,000 and will buy new machine-shop tools.

The C. O. Bartlett & Snow Co., Columbus Road and Merwin Ave., Cleveland, Ohio, will construct a foundry for iron working in making coal tipples, coal machines for mines and docks and other conveying machinery.

The Atlas Bolt & Screw Co., 1289 Marquette Road, Cleveland, will buy power equipment and machine tools for a new plant.

The Maxwell-Briscoe Motor Co., Newcastle, Ind., has ordered plans for the construction of an addition to the local factory. Machinery, valued at $200,000, will be installed.

The Citizens' Electric Light & Power Co., Lebanon, Ind., will install a gas plant, a central heating plant and an artificial ice plant in connection with its electric-light plant. B. F. Jones is superintendent and chief engineer.

The Grand Rapids Ry. Co. has awarded the general contract for the one-story car barn and power house, to be located at Court and Front Sts., Grand Rapids, Mich.

Plans are being prepared by G. W. Graves, 56 Rowland Building, Detroit, Mich., for a power plant and foundry for the Murphy Iron Works. Estimated cost, $40,000.

Young Bros., sheet-metal workers and makers of auto parts, 313 Franklin St., Detroit, Mich., are erecting an addition to their plant.

The Warren Motor Car Co., end of Third Ave. car line, Detroit, Mich., has increased its capital from $300,000 to $600,000, most of which will be spent for new buildings and equipment. Lucius E. Wilson is general manager.

The two buildings of the plant of the Missouri Malleable Iron Co., Champa, East St. Louis, Ill., which were recently destroyed by fire, will be rebuilt. The loss is estimated at $35,000, covered by insurance. F. E. Mulsen is president.

The Burr Foundry Co., Urbana, Ill., is planning the erection of a factory and power plant, offices, pattern shops and storage rooms. The estimated cost is $75,000.

Sam Garvin & Co., electrical contractors, 5124 West Lake St., Chicago, will build a two-story brick factory and equip it to manufacture electrical supplies.

Jacksonville, Ill., is considering the construction of an electric-light plant. Estimated cost, $40,000.

The Stutz Motor Car Co., Milwaukee, Wis., is planning to erect a garage to cost $10,000. E. F. Arlington, Majestic Building, is manager.

The Peaceful Valley Mining Co., Platteville, Wis., will erect a new 100-ton mill and a steam and electric power plant.

WEST OF THE MISSISSIPPI

The Gould Balance Valve Co., Kellogg, Iowa, will build a brick and concrete addition to its factory.

The Leonard Construction Co., 193 Michigan Ave., Chicago, Ill., has been commissioned by the Western Implement & Motor Co., Davenport, Iowa, to prepare plans for the construction of a new plant. The following buildings will be erected: a main building, 80x1000 ft.; garage, 20x80 ft.; foundry, 80x500 ft.; office building, 50x75 ft.; shop, 60x500 ft.; power plant, 75x100 ft.; oil and paint house, 50x80 ft., and two warehouses, 80x500 ft. All will be of reinforced-concrete construction and work will be started this spring.

The Minneapolis Steel & Machinery Co., Minneapolis, Minn., will build an addition to its mechanical plant to cost $50,000. The building will be of brick and steel.

The Atchison, Topeka & Santa Fé R.R. has announced plans for the construction of a new building at the shops at Topeka, Kan. It will be one story high, 120x240 ft., of concrete and brick construction, and will be used for the service department. W. A. George, Albuquerque, N. M., is superintendent of shops.

The Western Iron & Foundry Co., Santa Fé Ave. and Second St., Wichita, Kan., is considering the enlargement of its machine shop.

The Omaha Motor Co. has been incorporated and will construct a factory for the manufacture of automobiles. The company is financed at $1,000,000. D. W. Henry, Omaha, is interested.

J. A. Rose & Son, Hastings, Neb., will erect a factory and brass foundry.

A stove factory will be erected at Tulsa, Okla. E. D. Mitchell, president of the Commercial Club, is interested.

WESTERN STATES

The Dayton Manufacturing Co., Dayton, Ore., has recently been incorporated and will start the construction of a factory for the manufacturing of tool handles and other articles.

The Cousins-Howland Auto Co., Hanford, Calif., plans the erection of a new commercial garage. Machinery will be installed.

The Baker-Hoey Co., 2442 South Broadway, Los Angeles, Calif., contemplates the erection of a plant at Oxnard, Calif., for the manufacture of typewriter supplies. M. L. Kuehne is interested.

Bids will be received by the Paymaster-General, U. S. N., for supplies to be delivered at the Mare Island Navy Yard, Calif., as follows, until 10 a.m., Mar. 26: Schedule 4385, Class 111, three turbo-generating sets, 35-kilowatt, direct-current, complete with all accessories, ready for installation and operation; until 10 a.m., Apr. 2, Schedule 4386, Class 1, one coal-handling apparatus, complete, with spare parts. The equipment consists of 26 double-cylinder, double-drum winches, 13 for closing and hoisting and 13 for swinging; 10 clamshell buckets, 1⅝ cu.yd. or one gross ton coal capacity, and 3 or ¾ gross ton capacity; 13 sets of cableway or transfer blocks and 13 sets of ropes.

The Los Angeles Submarine Co. is contemplating erecting a factory in San Diego. E. C. Cunningham is interested.

The Peterborough Model Foundry & Manufacturing Co., Peterborough, Ont. has been incorporated, with a capital of $40,000, to establish a manufacturing plant. The incorporators are T. H. Ruble, J. Condon and W. H. Pethic.

General Manufacturing

NEW ENGLAND

The Bates Street Shirt Co., Lewiston, Maine, has had plans prepared by Coombs Bros., Lewiston, for the construction of a factory on Bates St. It will be five stories high, of reinforced concrete.

The Storey Manufacturing Co., Camden, Maine, will erect a new two-story shirt factory in that place.

The Halifax Mill, Lakeport, N. H., has been leased by the Mayo Machinery Co. Equipment is needed.

The W. H. McElwain Co., South Manchester, N. H., is to erect a new shoe factory, 550x54 ft., with two wings 328x54 ft. The factory will be five stories high.

The Thacker Paper Co., 265 Bridge St., Springfield, Mass., will increase the capacity of its plant.

Fire caused a $150,000 loss to the lumber plant of C. A. Pullen & Co., Attleboro, Mass.

Wiley & Foss have the contract for the addition to the mill of Crocker, Burbank & Co., Inc., Fitchburg, Mass. It will be brick, 80x100 ft., two stories high, of mill construction. George F. Harty is the engineer.

Samuel M. Green, Inc., architect, Springfield, Mass., is completing plans for an addition to the factory of the National Blank Book Co., Holyoke, Mass. The present building will be raised one story, 42x118 ft., of brick, mill construction, with a tar and gravel roof.

The Hoffman Paint & Varnish Co., Medford St., Boston, Mass., has purchased the plant of the Faxon Iron Foundry, West Everett, Mass. The company will rebuild and add other buildings and equipment for manufacturing purposes.

The plant of the Bay State Comb Co., manufacturer of celluloid articles, Leominster, Mass., was almost destroyed by fire.

Plans are being prepared by McClintock & Craig, of Springfield, Mass., for the new manufacturing building to be erected at the corner of James St. and Linen Ave., Bridgeport, Conn., by the Bias Narrow Fabric Co. It will be of brick, mill onstrution.

Four factory buildings are to be erected for the Tyer Rubber Co., Andover, Mass. All will be of brick and of following dimensions: 64x310 ft., three stories; 54x290 ft., one story; 50x75 ft., and 70x79 ft., one story each. Chas. T. Main, 201 Devonshire St., is the Engr.

O. C. S. Ziroli has completed plans for a factory building for George Demars. It will be built at Union and Thomas Sts., Worcester, Mass., and will be of steel and reinforced flat slab construction, 66x133 ft., four stories high.

The Stoneleigh Water Co. will establish a water system at Johnston, R. I. Dr. August Memmert is at the head of the concern.

The jewelry factory of Vester Bros., Providence, R. I., was damaged by fire. Loss, $20,000.

The Royal Chemical Co., Harris, R. I., contemplates installing new boilers. W. A. Phelan is superintendent.

The Warner Bros. Co., Bridgeport, Conn., are about to make an addition to its corset plant, on Gregory St. It will be 40x212 ft., six stories high, of mill construction.

The silk company of M. Heminway & Sons Co., Waterbury, Conn., has outgrown its present plant and contemplates erecting a new factory.

The Hart & Cooley Co., New Britain, Conn., has awarded the contract for a new factory building to be erected at Booth and Orange Sts. It will be of brick, mill construction, 45x123 ft., two stories high.

A fire at the paper mill of C. H. Dexter & Sons, Windsor Locks, Conn., did damage to the extent of several thousand dollars.

The Torrington Building Co., of Torrington, Conn., has been awarded the contract for an addition to the factory of the Winsted Hosiery Co., Holabird Ave., Winsted, Conn. A four-story addition, 16x38 ft., and a two-story addition, 38x65 ft., will be built. It will be built of brick, mill construction. E. E. Benedict, Waterbury, is the architect.

The contract to build a new factory on Schuyler Ave., Stamford, Conn., for Maxim & Maxim, manufacturers of straw hats, now at 752 Broadway, New York, N. Y., has been given to the Vuono Construction Co. The plans are by Nelson E. Emmens, and show a four-story building, 78x34 ft., of brick, mill construction. The cost will be about $16,000.

It is reported that the Nichols Underwear Co. is contemplating the erection of a branch plant at Danbury, Conn., that will employ 100 people.

It is reported that the American Thread Co., Willimantic, Conn., is planning a large addition to its plant. A power house will also be built.

John C. Nitchie, 150 Nassau St., New York, N. Y., is preparing plans for a plant for the Birdsey-Somers Co., corset manufacturers, at Barnum Ave. and Ridgefield St., Bridgeport, Conn. A group of thoroughly uptodate factory buildings, of either brick or concrete, will be erected.

MIDDLE ATLANTIC

Plans are being prepared by Tabor & Baxter, architects, Syracuse, N. Y., for the construction of a three-story factory, 50x110 ft., to be erected for the Pierce, Butler & Pierce Co., Eastwood, N. Y.

The Candee Incubator & Brooder Co., De Witt, N. Y., has purchased property at Eastwood, N. Y., where it will erect a plant.

Plans have been completed by Balch & Beardsley, architects, 38 West Thirty-second St., New York, N. Y., for the construction of a macaroni factory for the C. F. Mueller Co., 93 Boyd Ave., Jersey City, N. J. It will be five stories high, 50x150 ft., of concrete and steel construction.

The Board of Contract and Supply in Yonkers, N. Y., will receive bids until Mar. 25, for a 10,000,000-gal. high-duty pumping engine and appurtenances. J. V. Mahony, clerk.

The planing mill of the Syracuse Woodcrafters Co., Syracuse, N. Y., was destroyed by fire. Loss, $25,000, partly covered by insurance.

The Norwich Knitting Co., of Norwich, N. Y., will increase its plant, spending $50,000.

The building on Bedford Ave., near Williamsburg Bridge, Brooklyn, N. Y., occupied by the Empire Upholstering Co., was damaged by fire, Mar. 1. Loss, $12,000.

The factory of the Consolidated Button Co., Nassau and Boyden Sts., Newark, N. J., was damaged by fire, Feb. 26. Loss, $25,000.

Davey & Crowther, architects, Coal Exchange Building, have completed plans for the construction of a laundry for Dominick F. Mulherin, 114 South Main St., Scranton, Penn. It will be three stories high, 40x45 ft., and cost $15,000.

Bunting & Shrigley, architects, 603 Chestnut St., Philadelphia, Penn., are preparing plans for the construction of a new printing plant, 22x114 ft., for the Biddle Press, 1010 Cherry St. The estimated cost is $30,000.

The four-story building at 757-761 Passyunk Ave., Philadelphia, occupied by D. Shultz, manufacturer of wall paper, and Nelson Avare, paper-box manufacturer, was damaged by fire, Mar. 4. Loss, $25,000.

The compound house and the wax-making department of the Emery Refining Co., Bradford, Penn., were destroyed by fire, Feb. 29, with a loss of $100,000.

The pulp keg mill of the Du Pont Powder Co., at Henry Clay, near Wilmington, Del., was destroyed by fire, Mar. 3. Loss, $500,000.

The Lorely Distilling Co. has acquired 47 acres of land on the Gunpowder River, Baltimore County, Md., and will erect a large plant there.

SOUTHERN STATES

A permit was issued to Mrs. Lizzie Sauer Dunstan to build a two-story brick, steel and concrete ice-cream factory on the North side of Broad St., between Meadow and Allison Sts., Richmond, Va. The structure will cost $18,000. It is to be occupied by L. K. Shepherd.

The Williamsburg Knitting Mill Co., Williamsburg, Va., is considering plans for the enlargement of its plant. New buildings will be erected and new machinery purchased.

The Clarksburg Pressing Co., Clarksburg, W. Va., has purchased a site on Traders Alley, upon which they will erect a two-story fireproof building, costing $15,000. H. A. Hunze is general manager.

The Carson-Hubbard Mill Co., Taylorsville, N. C., has had plans completed for the construction of a new mill. It will be 50x150 ft., of brick construction. J. C. Connelly is manager.

Sol Bear & Co., Wilmington, N. C., have purchased a site upon which they will erect a winery. It will be three stories high, 75x150 ft., of brick and steel construction. The estimated cost is $30,000. Burrett H. Stephens, I.O.O.F. Building, is the architect.

The factory of the Charlotte Clothing Manufacturing Co., Charlotte, N. C., was damaged by fire, Feb. 21. Loss, $13,000. Covered by insurance.

The Brown Printing Co., 10 North Lawrence St., Montgomery, Ala., has awarded a contract to C. B. Ratliff, Montgomery, for the construction of a new printing plant. It will be three stories high, 50x100 ft., of brick and reinforced-concrete construction. The estimated cost is $30,000. J. H. Crenshaw is president.

The band mill of the Brookhaven Lumber Manufacturing Co., Hattiesburg, Miss., was destroyed by fire. Loss, $10,000. Covered by insurance.

MIDDLE STATES

The Knox Monumental Co., Bellevue, Ohio, will buy some pneumatic stone-working tools.

The H. G. Ritter Cigar Box Co., Deshler, Ohio, just incorporated to manufacture wooden cigar boxes, will buy wood-working machinery for a plant.

The Lake City Ice Co., Cleveland, Ohio, will make additions to its ice-making plant.

Fire destroyed the large plant of the Wickham Piano Manufacturing Co., at Springfield, Ohio.

Fire caused considerable loss to the plant of the Huss Bros. Furniture Co., at Cincinnati, Ohio.

A complete ice-making plant will be built by the City Ice Co., at Cleveland, Ohio.

Power equipment will be purchased by the Osnaburg Brick Manufacturing Co., Canton, Ohio.

The packing house and cold-storage plant of the Kishman Fish Co., at Huron, Ohio, has been destroyed by fire. Loss, $25,000. They will be rebuilt immediately.

The Lorain Dry Cleaning Co., Lorain, Ohio, will buy complete equipment for a new cleaning plant.

The Standard Oil Co. will erect and equip a large pump house at Cleveland, Ohio.

The American Linseed Co., Cleveland, Ohio, will build additions to its present plant.

The I. Leisy Brewing Co., Cleveland, Ohio, will add mechanical equipment to its present plant.

Power equipment will be purchased by the Citizens Sand & Gravel Co., at Toledo, Ohio. G. Cooper is manager.

The Liberty Light & Power Co., Liberty Center, Ohio, will buy power and electrical equipment for a new lighting and power plant.

The Broadway Lumber Co., Cleveland, Ohio, just organized, will buy mill machinery. Jay A. Towsley is manager.

The City Ice Delivery Co., Cleveland, Ohio, has awarded the contract for the erection of an ice-manufacturing plant at Elk Ave. and East One Hundred and Fifth St. Plans were prepared by C. C. Coneby.

The plant of the Central Glass Co., Utica, Ohio, has been destroyed by fire. Loss, $40,000.

Walker & Weeks, architects, 1900 Euclid Ave., Cleveland, Ohio, are preparing plans for the erection of a new factory for the S. Korach Co., 1219 West Ninth St. The estimated cost is $75,000.

The Firestone Tire & Rubber Co., Akron, Ohio, will equip its old tire plant to make demountable auto rims.

The Louisville Lumber Co., Louisville, Ohio, will buy some wood-working machinery for its mill. H. S. Cholley is manager.

The plant of the Central Window Glass Co., of Utica and Newark, Ohio, was destroyed by fire, Mar. 2. Loss, $50,000; partly covered by insurance.

The plant of the Owens Bottle Machine Co., 982 Libbey St., Toledo, Ohio, was destroyed by fire, Mar. 2. Loss, $100,000. Insurance, $70,500.

A loss of $30,000 was caused by a fire in the plant of the Star Stoneware Co., at Crooksville, Ohio.

Contracts for the construction of the new bottling plant of Christ Kanzler & Sons, Evansville, Ind., have been awarded at a total cost of $n2,997. The building will be of brick and steel, 114x150 ft., two stories high.

The W. I. Salee Co., of Indianapolis, Ind., coal dealers and artificial ice makers, will spend $100,000 in improvements to its plant. Ice-making machinery will be bought and a 10,000-ton coal-storage elevator will be erected. The power-plant equipment will be enlarged and automatic stokers installed.

The American Lace Co., of Elyria, Ohio, is considering establishing a branch plant in Detroit, Mich.

The Big Rapids Furniture Manufacturing Co., 128 Baldwin St., Big Rapids, Mich., is considering plans for the construction of a new factory. It will be three stories high, 60x150 ft., of mill construction. J. C. Martz is general manager.

The plant of the Grand Rapids Cigar Box Co., at Grand Rapids, Mich., was destroyed by fire, Feb. 28. Loss, $50,000.

R. H. Marr, architect, Penobscot Building, Detroit, Mich., is receiving bids for the construction of a two-story laundry, 40x102 ft., to be erected on Woodward Ave., for the Monarch Laundry Co., 345 Woodward Ave.

Pollmar & Ropes, 602 Sun Building, are preparing plans for a five-story and basement factory building, 130x50 ft., to be located on Second Ave., Detroit, Mich. The estimated cost is $50,000.

R. O. Rosen, architect, Powers Building, Decatur, Ill., has completed plans for the construction of a new laundry for Frank Whitmer, 475 Decatur St. It will be two stories and basement, and cost $50,000.

Armour & Co., Union Stock Yards, will build a six-story brick factory at West Forty-third St., and Packers Ave., Chicago, Ill., and will equip it to manufacture canned goods.

Dixie Mills Co. will build a large plant at East St. Louis, Ill., to manufacture cereal products.

The harness factory of Bassett Echlin Harness Co. was burned at Janesville, Wis. Loss, $15,000, partly covered by insurance.

The Footville Condensed Milk Co., of Brodhead, Wis., awarded a contract for the erection of its new plant to the Denmark Construction Co., of Chicago, Ill.

The Centralia Pulp & Water Power Co., Grand Rapids, Wis., manufacturer of pulp, has awarded a contract to J. C. Jacobson, Grand Rapids, for the construction of a new factory. It will be of brick, 75x175 ft., and two stories high.

H. Danischfesky, 1060 Eighth St., Milwaukee, Wis., is receiving bids for the construction of a refrigerating plant, to be erected at Tenth and Chestnut Sts., for the Pabst Brewing Co. It will be of brick, seven stories, 140x208 ft.

The Eau Claire Box Co., Eau Claire, Wis., was destroyed by fire. Loss, $16,000.

Nels Enge, of Minneapolis, Minn., proposes establishing a flour mill, of 125 barrels capacity, at Conrad, Mont.

Martin Tuma will erect a modern saw-mill, at New Prague, Minn.

The Canadian Northern Ry. will build grain elevators and docks, at Duluth, Minn. T. Turnbull, Winnipeg, Man., is chief engineer.

Plans are being prepared by Reed & Stem, architects, 601 Endicott Building, St. Paul, Minn., for the construction of a two-story pressed brick and cut stone fireproof candy factory for J. George Smith, on Bedford Ave. The estimated cost is $125,000.

The Imperial and the Farmers' grain elevators, at Erie, N. D., were destroyed by fire, Feb. 26. Loss, $40,000.

The Henningsen Produce Co.'s Butte, Mont., cold-storage plant was damaged by fire. Loss, $5000.

The plant of the Montana Packing Co., Butte, Mont., was destroyed by fire, Feb. 27. Loss, $50,000.

The plant of the Wainwright Brewing Co., Papin and Eleventh Sts., St. Louis, Mo., was damaged by fire, Mar. 1. Loss, $1500.

Goodwin Bros., 2609 North Broadway, St. Louis, Mo., are considering plans for the erection of a new printing and binding plant. It will be two stories high, 40x150 ft., of reinforced concrete and cost $25,000.

Plans for the erection of a new hardwood mill are being considered by the Choates Creek Lumber Co., Livingston, Tex. G. W. Turney is manager.

The Merchants Ice and Cold Storage Co., San Antonio, Tex., will double the capacity of its ice factory and cold-storage plant here. C. W. Fichtner, of San Antonio, Tex., is interested.

The Wisconsin Sugar Beet Co., of Milwaukee, Wis., has taken preliminary steps to establish three beet-sugar factories in Texas. One of these is to be located at Austin, another at Plainview and a third at Amarillo. It is stated by R. G. Wagner, president of the company, that each factory will cost from $1,000,000 to $1,500,000.

S. W. Gilbert and Dr. A. M. Thomas, Artesia, N. M., are planning for the construction of a canning plant, at Artesia.

WESTERN STATES

The Idaho Brick, Tile & Pottery Co., Cœur d'Alene, Idaho, has been incorporated, with a capital of $100,000, and will soon erect a plant, at Cœur d'Alene, for the manufacture of brick, tile and pottery. William I. Shockley is president.

The Orofino Portland Cement Co., Orofino, Idaho, recently organized, will soon commence the erection of a new cement-manufacturing plant, at Orifino, to cost about $1,250,000. Modern machinery will be installed. D. G. Munro, Howard Witherspoon and J. H. Tilsley, Spokane, Wash., are interested.

The factory of Nash Trunk Co., Jackson St., Sioux City, Idaho, was damaged by fire, Feb. 29. Loss, $2000.

Dr. Hascall and associates, Fallon, Nev., are contemplating the erection of an alfalfa-meal plant, at Fallon.

The Muddy Valley Irrigation Co., Winnemucca, Nev., is planning to construct a complete new irrigation system, at a cost of about $40,000. Two electric-power plants will also be constructed.

The Alpha Mine, Phoenix, Ariz., plans for the installation of a new milling plant.

The Spokane Belting Co., Spokane, Wash., has leased a building on Browne St., and will install machinery for the manufacture of belting and supplies. R. L. Womack and R. Seidel are interested.

The Northwestern Yeast Co., Chicago, Ill., 1750 North Ashland Ave., contemplates the erection of a yeast-manufacturing plant, at Sumner, Wash. The plant will be fully equipped.

The Crown-Columbia Paper Co., Camas, Wash., plans for the installation of new machinery at its new plant now being erected.

Thompson & Magnason, English, Wash., have secured a site, at Lyman, Wash., and will erect a new shingle mill.

The Morrell Packing Co., Ottumwa, Iowa, will build a large packing plant, on DeSmet Ave., Spokane, Wash.

The Sylvia Mill recently burned at Montesano, Wash., will be rebuilt at once.

The Montesano Incubator Co. will erect a factory, at Montesano, Wash.

The Matthaei Bread Co., Tacoma, Wash., plans for the erection of a new plant. Estimated cost, $30,000.

The Oriole Candy Co., Tacoma, Wash., will erect a new plant, on East Twenty-eighth St. Dugan & Lewis, Tacoma, are the architects.

The Pacific Coast Coal Co. will erect a factory for the manufacture of briquettes, at Renton, Wash. The cost will be $250,000.

The city of Carlton, Ore., has voted bonds for the installation of a water-works system.

The Portland Lumber Co., Roseburg, Ore., contemplates the erection of a new lumbering plant, on Wilson Creek, near Riddle, Ore. The plant will have a daily capacity of 35,000 ft., and will be fully equipped.

Robert A. Johnson, San Francisco, Calif., will erect a plant, at Klamath Falls, Ore., for the manufacture of boxes.

J. E. Cogswell, Riverside, Calif., has acquired property in the Perris Valley, Calif., and plans for the installation of a pumping plant.

The Independent Stone Co., San Diego, Calif., is contemplating extensive improvements in its plant, at Spring Valley, near San Diego. The cost will be about $40,000.

The Alameda Sugar Co., Meridian, Calif., will soon begin the construction of a new beet-sugar plant here. The plant will be fully equipped, and will cost $1,500,000. H. White represents the company.

The Growers' Fruit Co., Ontario, Calif., has taken out a permit for the erection of a new packing plant.

Dr. C. A. Wayland, D. M. Stanley, Los Angeles, Calif., and James Pitman, San José, Calif., have acquired property at Terra Bella, Calif., and plan for the installation of three new irrigation systems.

The Bay City Brewing Co., San Diego, Calif., will soon commence the erection of a new plant here.

The Brookings Lumber & Box Co., Bloomington, Calif., plans for the erection of additions to its plant.

The Buchanan Lumber Co., San Diego, Calif., has applied to the city council for a lease of tide lands between Twenty-seventh and Twenty-eighth Sts., San Diego, and contemplates the erection of wharves, warehouses and a lumbering plant, to cost about $40,000. J. C. Buchanan is president.

J. J. O'Neill, Spokane, Wash., plans for the erection of a planing mill and box-manufacturing plant, at El Segundo, Calif.

P. H. Johns, Olympia, Wash., and associates, will erect a new finishing mill, at San Diego, Calif.

The Red Bluff Wool Scouring & Warehouse Co., Red Bluff, Calif., will build a big plant and storage quarters, at Madison and Elm Sts. The building will be a two-story structure, 150 ft. long and 115 ft. wide, and considerable wool-scouring machinery will be installed, amounting to about $18,000.

The Cereal Food & Feed Co., Richmond, Calif., whose plant was recently burned, entailing a loss of $50,000, will rebuild their factory and warehouse, the buildings to be of corrugated iron and brick.

The Antioch Paper Mills, Antioch, Calif., will be remodeled and additional machinery will be installed.

The Bear Valley Extension Water & Pipe Line Co., Redlands, Calif., plans for the extension of its water system. The expenditure will be $25,000.

The Glendora Lemon Growers' Association, Glendora, Calif., plans the erection of a new packing plant.

The Globe Grain & Milling Co., Los Angeles, Calif., will erect four large grain elevators, at San Pedro Harbor, Calif.

The city of Lakeview, Calif., is planning for the installation of a modern sewerage system.

The city of Maricopa, Calif., plans for a bond issue of $20,000, for the installation of a modern sewerage system.

The Lodi Natural Gas Co., Lodi, Calif., plans for the erection of a new plant to manufacture gas. The plant is estimated to cost $40,000.

The San Diego Vitrified Brick & Clay Products Co., San Diego, Calif., will erect a new plant for the manufacture of its specialties. The plant will be fully equipped.

The International Fisheries Co., Los Angeles, Calif., is planning for the erection of two new fish-canning plants, one at Cedros Island, near Mexico, and one at the mouth of the Colorado River, on the coast of Mexico.

J. Parker Whitney, San Francisco, Calif., is contemplating the erection of a large orange-packing plant, at Penryn, Placer County, Calif.

The bed and mattress factory of the Rudgear-Merle Co., Bay and Stockton Sts., San Francisco, Calif., was damaged by fire, Feb. 26. Loss, $2000.

CANADA

John Bond, James Drummond and J. H. Gray, Victoria, B. C., have acquired property on Pender Island, and plan for the erection of a plant for the manufacture of vitrified sewer and street pipe and paving brick.

The American Lumber Co., Huntington, B. C., plans for the installation of new machinery at its new plant here.

The International Milling Co., Vancouver, B. C., is planning for the erection of a large terminal elevator and a flour plant, at Port Mann, B. C. A large oatmeal plant will also be erected.

The Ontario & Minnesota Power Co. will install a 100-ton paper mill and a 100-ton pulp mill, at Fort Frances, Ont.

The Dominion Canners Association have secured a site at Ridgetown, Ont., and will soon erect a building which will be equipped as a modern canning plant. W. H. Schott, of Waterford, is in charge. The estimated cost is $75,000.

The Knechtel Furniture Co. will locate a new factory at Southampton, Ont.

The Rudd Box Co. will extend its plant in Toronto, Ont.

The International Milling Co., of New Westminster, B. C., will locate a large new mill there and install the latest machinery.

The Okanagan Falls Lumber Co. will buy large quantities of machinery for new mills to be located in British Columbia. Head office, Okanagan, B. C.

The Canada Malting Co., of Calgary, Alta., will build a new plant.

J. Goodwillie will equip a new canning factory at Welland, Ont., and install the latest equipment.

The British American Bank Note Co., of Ottawa, Que., will erect a $75,000 addition to its plant.

The New Hamburg Felt Boot Co., of New Hamburg, Ont., will double the capacity of its factory.

New Incorporations

METAL WORKING

The Acme Register Co., Somerville, Mass., has been incorporated with a capital of $500,000. The incorporators are Frank L. White, Middleboro; Henry J. Roberts, South Boston, and Delevan C. Delano, Carney Building, Boston, Mass.

The United States Envelope Sealing Machine Co., Springfield, Mass., has been incorporated with a capital of $50,000. The incorporators are Carl H. Davis, E. Longmeadow and Clarence H. Green, Springfield.

The Southern New England Engineering Corporation, of Bridgeport, Conn., has been incorporated with a capital of $2000 to manufacture machinery. The incorporators are Chas. L. Gulisk, of Bridgeport; John H. Faraday, of Arlington, N. J., and Morgan L. Parks, of Closter, N. J.

John N. Leiss Co., 61 Arlington St., Newark, N. J., has been incorporated with a capital of $50,000 to manufacture jewelry and ornamental novelties. The incorporators are Emma G. Leiss and John N. Leiss, 161 South Sixth St., Newark, N. J., and William B. Powell, 122 North Sixteenth St., Orange, N. J.

C. L. Grant, Inc., Hartford, Conn., has been incorporated with a capital of $50,000 to manufacture artesian-well machinery. The incorporators are Chas. L. Grant and Clara Grant, Hartford, and C. E. Grant, Coventry.

The Peerless Roller Bearing & Appliance Co., 33 North Second St., Camden, N. J., has been incorporated with a capital of $300,000. The incorporators are P. E. Sharpless, Ward, Penn.; Wm. H. Kneedler, Lansdale, Penn., and Isaac Michener, Jenkintown, Penn.

The Jones & Laughlin Steel Products Co., Pittsburg, Penn., has been incorporated with a capital of $25,000. The incorporators are John L. Haines, Pittsburg, Penn.; Thomas Anderson, Crafton, Penn., and Geo. A. Mason, Sewickley, Penn.

The Ferrum Manufacturing Co., Pittsburg, Penn., has been incorporated with a capital of $10,000 to manufacture machinery. The incorporators are W. P. Wieman, Wm. Martin and Robert A. Gillispie.

The Dillon Safety Razor Co., Dover, Del., has been incorporated with a capital of $100,000 to manufacture safety razors and all kinds of cutlery. The incorporators are S. V. Dillon, Chas. F. Lewis and W. A. McCoy, of Pittsburg, Penn.

The Moore Locomotive Ash-Pan Co., Montgomery, Ala., has been incorporated with a capital of $32,000. The incorporators are W. S. Monk, J. I. McKinney and Q. C. Campbell.

The Power Plant Machinery Co., Cleveland, Ohio, has been incorporated with a capital of $1000. The incorporators are Geo. W. Bach, Chas. A. Morris and B. H. Rose.

The Smith-Backmann Machine Co., Youngstown, Ohio, has been incorporated with a capital of $10,000. The incorporators are Horace L. Smith, Carl Hildebrand and Ed. C. Backmann.

The Woodside Machine Shop, Indianapolis, Ind., has been incorporated with a capital of $2500. The incorporators are A. O. Schoen, C. S. Pollard and Harvey Wilhite.

The Peerless Cigar Lighter Co., Anderson, Ind., has been incorporated, with a capital of $20,000. The incorporators are A. H. Ashbaugh, Samuel Leveen and others to do a manufacturing business.

The Spread Eagle Hoe Co., Benton Harbor, Mich., has been incorporated, to manufacture a patent hoe. C. Brooks, president; S. W. Shanks, vice-president; C. Shanks, secretary and treasurer.

The Hydraerocraft Co., Chicago, Ill., has been incorporated, with a capital of $25,000, to manufacture flying machines. The incorporators are H. P. Keane, R. Middlekauff and H. S. Grosser.

The Illinois Silo Co., Bloomfield, Ill., has been incorporated, with a capital of $100,000, to manufacture silos. The incorporators are W. H. Boyer, C. I. Will, C. C. Bowman and G. C. Heberling.

The Kropp Forge Co., Chicago, Ill., has been incorporated with a capital of $40,000 to manufacture machinery. The incorporators are Chas. A. Kropp, Frank Schoenfeld and Benjamin Ehrlich.

The Rock Island Bridge & Iron Works, Chicago, Ill., has been incorporated with a capital of $30,000 to manufacture and erect structural iron work. The incorporators are M. H. Kanary, Walter C. Murphy and Edward Manhard, 1120 Thirty-seventh St., Chicago, Ill.

The Englewood Chandelier Co., Chicago, Ill., has been incorporated with a capital of $35,000 to manufacture metal goods. The incorporators are H. A. Davis, A. F. Hansen and W. E. Pemberton, all of Chicago.

The East Side Foundry Co., Chicago, Ill., has been incorporated with a capital of $2000. The incorporators are Herman Mendel, Isabel O. Mendel and Patrick D. Mallot.

The Miller Gas & Vacuum Engine Co., Chicago, Ill., has been incorporated with a capital of $5000 to manufacture engines. The incorporators are B. F. March, W. H. Eckert and M. I. Twohey.

The Weishaupt Iron & Wire Works, Chicago, Ill., has been incorporated with a capital of $2500. The incorporators are Ernest A. Weishaupt, Emma Weishaupt and Geo. G. Koltz.

The Metal Crafts Co., Chicago, Ill., has been incorporated with a capital of $20,000. The incorporators are Ad. H. Theile, Leonard E. Maas and M. C. Fitzpatrick.

The Paragon Foundries Co., Chicago, Ill., has been incorporated with a capital of $24,000. The incorporators are Thomas J. Condon, I. J. Livingston and Leo H. Sachs.

The Modern Stove Co., Chicago Heights, Ill., has been incorporated with a capital of $125,000 to manufacture cooking and heating devices. The incorporators are J. R. Hobrecker, William Boeck and Geo. A. Brinkman.

The Milwaukee Milling Machine Co., Milwaukee, Wis., has been incorporated for $5000 by the owners of the Kearney & Trecker Co., milling machinery, to hold patent rights on the Milwaukee milling machines.

The Sterling Machine Co., La Crosse, Wis., has been incorporated, to manufacture brick machines. The incorporators are J. Wright, E. Wege and P. Christell.

The National Steel Housing Co., Milwaukee, Wis., has been incorporated with a capital of $100,000. The incorporators are Geo. Jirsa, John Loehner and Anthony E. Fless.

The Williamson Machinery Co., Milwaukee, Wis., has been incorporated with a capital of $5000. The incorporators are S. R. Williamson, J. F. Curley and Geo. Harry.

The Acme Machine Works, St. Louis, Mo., has been incorporated with a capital of $6000 to manufacture machinery. The incorporators are Frederick Boercker, John W. Ellebrecht and Margaret Boercker.

The Pehl Metal Products Co., Kansas City, Mo., has been incorporated with a capital of $25,000. The incorporators are G. H. Pehl, F. W. McMillan and B. H. Smith.

The Kansas City Metal Products Co., Kansas City, Mo., has been incorporated with a capital of $10,000. The incorporators are A. F. Brocker, H. J. Olney and F. E. Loveland.

The Texas Foundry & Machine Co., Dallas, Tex., has been incorporated with a capital of $10,000. The incorporators are E. B. Bowland, J. H. Durkee and R. W. Marple.

The P. A. Coon Silver Manufacturing Co., Los Angeles, Calif., has been incorporated with a capital of $10,000. The incorporators are P. A. Coon, C. A. Bettinger and F. D. Coon.

The General Machinery Manufacturing Co., Los Angeles, Calif., has been incorporated with a capital of $25,000. The incorporators are G. T. Stoneham, W. W. Brassington and C. J. Stoneham.

The American Pump Co., Los Angeles, Calif., has been incorporated with a capital of $20,000. The incorporators are C. U. Martin, F. J. Bruguiere and P. H. Coop.

Business Items

The Westinghouse Electric & Manufacturing Co. announces that C. C. Owens has recently been placed in charge of the Detroit district sales office, with the title of district manager. For the last eight years he has been connected with the New York sales office, having had charge of the industrial and power division for the two previous years to his transfer to Detroit.

The Conover-Overkamp Machine & Tool Co., a new corporation, of Dayton, Ohio, has taken over the Miami Valley Machine Tool Co., of that city. C. H. Overkamp is the new member of the company. He has been identified with machine-tool business for a number of years in Cincinnati and Canada, and will devote his time and attention to the designing and manufacturing end of the business. P. P. H. Conover has been connected with the Miami Valley Machine Tool Co. since its organization, and is well known to the machine-tool trade. Mr. Conover will continue to look after the sales end of the business.

Trade Catalogs

Spicer Mfg. Co., Plainfield, N. J. Universal joints. Illustrated, 16 pages, 4½x6½ in.

The J. N. Lapointe Co., Marlboro, Mass. Circular. Broaching machine. Illustrated.

Falls Machine Co., Sheboygan Falls, Wis. Catalog. Automobile motors. Illustrated, 9x12 in.

The Robinson Tool Works, Hartford, Conn. Circular. No. 1, bench filing machine. Illustrated.

Burke Electric Co., Erie, Penn. Bulletin No. 111. Speed change system. Illustrated, 4 pages, 8x10½ in.

Cling-Surface Co., Buffalo, N. Y. Folder. Cling-Surface treated belts in several shops. Illustrated.

The Hartford Machine Screw Co., Hartford, Conn. Catalog. Automatic tire pumps. Illustrated, 12 pages, 6x9 in.

Vixen Tool Co., 5001 Lancaster Ave., Philadelphia, Penn. Bulletin B. Vixen files. Illustrated, 22 pages, 7½x10 in.

The Cork Insert Co., 16 State St., Boston, Mass. Booklet. "Here's the Proof." Testimonial letters. 50 pages, 6x9 in.

Farrel Foundry & Machine Co., Ansonia, Conn. Catalog. Coil friction clutches. Illustrated, 28 pages, 8x10½ in.

S. K. F. Ball Bearing Co., 50 Church St., New York. Bulletin No. 2. Single and double thrust bearings. Illustrated, 16 pages, 6x9 in.

Sprague Electric Works, 527 West Thirty-fourth St., New York. Catalog No. 325. Electric fans. Illustrated, 40 pages, 8x10½ in.

The Hendey Machine Co., Torrington, Conn. Pamphlet. Improved relieving attachment, Type C. Illustrated, 22 pages, 4½x7½ in.

Wisconsin Motor Mfg. Co., Milwaukee, Wis. Catalog. Motors for automobile, truck and marine purposes. Illustrated, 48 pages, 6x9 inches.

The Carlyle Johnson Machine Co., Manchester, Conn. Booklet. The Johnson friction clutch applied in machine building. Illustrated, 40 pages, 6x9 in.

Morse Twist Drill & Machine Co., New Bedford, Mass. Catalog. Twist drills, reamers, chucks, milling cutters, taps, dies, etc. Illustrated, 366 pages, 5x7 in.

Charles H. Besly & Co., 118-124 North Clinton St., Chicago, Ill. Catalog. Spiral disk grinders, band polishing machines, Helmet spiral circles, etc. Illustrated, 112 pages, 6x9 in.

Lucas Machine Tool Co., Cleveland, Ohio. Circular F-6. Vertical milling attachment for precision boring, drilling and milling machine. Illustrated. Circular F-10. No. 33. Precision boring, drilling and milling machine. Illustrated.

Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin E-19. Universal electric drills, direct or alternating current. Illustrated, 8 pages, 6x9 in. Bulletin E-20. Electric drills for heavy duty, direct current. Illustrated, 8 pages, 6x9 in. Catalog No. 38. Model D "Little Giant" commercial car. Illustrated, 24 pages, 6x9 in.

Forthcoming Meetings

National Metal Trades Association. Fourteenth annual convention, Apr. 11, Hotel Astor, New York City. Robert Wuest, commissioner, New England Building, Cleveland, Ohio.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

DRAFTSMEN on design, detail and tool work; also pattern makers familiar with automobile work. Apply factory office, The Pope Manufacturing Co., Hartford, Conn.

Illinois

DESIGNER, experienced on wire forming machines such as pins, safety pins, etc.; state age, experience and salary desired. Box 54, Am. Machinist.

Indiana

FOREMAN for machine shop in factory employing 100 men; must be first-class die and tool man and accustomed to light, fairly accurate work; salary, $27.50 weekly; in applying write fully in first letter. Box 6, Am. Machinist.

Maryland

SHIPYARD FOREMAN on steel hulls. Address Box 74, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

MARINE DRAFTSMAN capable of taking off quantities and weights and preparing schedules for estimates. Address Box 33, Am. Machinist.

Michigan

TOOLMAKERS — Several men with first-class experience on jigs and fixtures; in writing, state age and experience in detail. Buick Motor Co., Flint, Michigan.

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

Missouri

BLACKSMITH, an all-around, for medium and light job work; one who understands getting out work under the steam hammer; steady employment; open shop. Box 31, Am. Machinist.

New Jersey

DESIGNER on tools and machinery for small interchangeable parts. Box 73, Am. Machinist.

New York

PATTERN MAKERS — Steady, first-class, others need not apply. Box 72, Am. Machinist.

MECHANICAL DRAFTSMAN, experienced on work for automatic machinery. Box 55, Am. Machinist.

DETAIL DRAFTSMAN; must have had at least two years' experience. Kerr Turbine Co., Wellsville, N. Y.

DESIGNING DRAFTSMAN for flat bed printing press; able man required; give qualifications in first letter. Box 58, Am. Machinist.

TOOL MAKER, on high grade jigs and gages; good position and good pay; state age, experience and positions held. Box 57, Am. Machinist.

DRAFTSMAN, with experience on fixtures, jigs and gages; position with excellent opportunities for good man. Box 56, Am. Machinist.

TOOL MAKER, who has had experience on small high speed lathes or quills; must furnish A-1 references as to character and ability. Address "Ball Bearings," Am. Machinist.

FACTORY FOREMAN, by established firm manufacturing hardware specialties; must be able to plan work, instruct men and thoroughly understand modern methods; prefer man experienced in this line; give references, age, salary. Box 64, Am. Machinist.

Ohio

MANAGER for machine shop, thoroughly familiar with Corliss pumping machinery and air compressors; must be a mechanical engineer, technical graduate, with both selling and shop experience; give reference, state age, experience and salary required. Box 8, Am. Machinist.

TRAVELING ENGINEER for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

INSPECTOR, at once, by Ohio manufacturer; man experienced in automatic engines of the single and four-valve types to act as inspector, and if necessary, foreman of machine work and erection; replies must give full particulars of experience, salary desired, etc., and will be treated strictly confidential. Box 70, Am. Machinist.

MECHANICAL DRAFTSMAN, at once, by Ohio manufacturer, who has had automatic-engine experience and who is thoroughly familiar with strength of materials and automatic engines of the single and four-valve types; replies must give full details of experience and salary desired and will be treated strictly confidential. Box 69, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

FOREMAN for shop, capable of handling general repairs on pumps, engines, electrical machinery and general class of work found in coal and coke plants; write fully age, nationality and references. Box 66, Am. Machinist.

DIE MAKER, sheet metal; must be skillful and able to design intricate labor-saving dies and get work out quickly; wages, $5 to $6 per day; unlimited advancement to man of skill and energy with progressive concern; full particulars and references required. Box 42, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Positions Wanted

Indiana

DESIGNER and constructor with broad experience on machine tools, dies, jigs and fixtures. Box 68, Am. Machinist.

Massachusetts

GENERAL MANAGER—For the last five years in entire charge of manufacturing and sales of a large metal-working plant requiring accurate machine work and fine finishing, and employing 1000 operatives; understands shop management on modern scientific lines; has been a successful salesman and sales organizer; exceptional experience in machinery equipment and shop economies; would accept managership of good concern, but prefers to take hold of some company that is financially strong and is in need of reorganization; principal ability is in reorganizing and building up sales and factory organization into a coöperative unit; salary, $10,000. Address P. O. Box 696, Worcester, Mass.

New Jersey

DRAFTSMAN, experienced in checking machine shop, tool room, instrument and vacuum-cleaner work; also interchangeable tools. Box 75, Am. Machinist.

MECHANICAL ENGINEER, chief draftsman and designer; age 40; technical and practical; experienced on hydraulic, general machinery, power plants, etc., is open for engagement in the metropolitan district; reference A-1. Box 32, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 48, Am. Machinist.

GENERAL SUPERINTENDENT and manager of large successful concern desires change; nine years in present position. Box 10, Am. Machinist.

DRAFTSMAN, 3½ years' varied experience, wishes to secure permanent position with opportunity of advancement. Box 27, Am. Machinist.

SUPERINTENDENT or foreman is open for engagement; wide experience in machine, tool, die and special machine work, also designing and drafting. Box 67, Am. Machinist.

MECHANICAL ENGINEER — Skilled mechanic, with 15 years' broad experience in designing of tools, efficiency methods and manufacturing, desires position. Box 49, Am. Machinist.

FOREMAN, tool room; a thorough, first-class man, particularly on dies, with uptodate ideas and capable of making his own drawings; now employed as such, wishes to make a change. Box 65, Am. Machinist.

MECHANICAL DRAFTSMAN, with broad experience special and automatic machine design, jigs, tools, etc.; thoroughly familiar with shop methods; competent and reliable; open for position. Box 77, Am. Machinist.

MECHANICAL ENGINEER, graduate, in responsible position, desires change; long designing, shop and selling experience in hydraulics, pumping and general engineering; organizing and inventive qualities. Box 61, Am. Machinist.

PRACTICAL factory office man, 26, married, well versed in cost accounting, purchasing, payroll and general routine; at present employed, would change for permanent position; moderate salary in New York or Brooklyn. Box 63, Am. Machinist.

TOOL MAKER—By a young, uptodate mechanic and toolmaker; 20 years' experience; first-class on all kinds of tools, gages, models and automatic machines; also had charge and held position as inspector; would prefer New York City, Newark, or about 100 miles around. Box 79, Am. Machinist.

GERMAN MECHANIC and constructor, with 25 years' experience in making apparatus, clocks, tools and small machinery, like to start a little modern model and experimental shop in New York; desires connection with a single concern about experimental or other precise work in this line. Box 78, Am. Machinist.

FACTORY SUPERINTENDENT, general foreman and master mechanic, now located with progressive firm, wishes position as factory superintendent or assistant; have A-1 record as organizer of production departments, expert in designing tools and labor saving devices; can handle with tact, skilled mechanics and operating force. Box 62, Am. Mach.

TOOL DESIGNER, superintendent; a New York man having a successful record as production engineer with a large Eastern corporation, would sever connections for more attractive inducements from a leading concern where ability and push are qualifications; 17 years' wide experience as machinist, draftsman and executive on light- and medium-weight machinery; a genius in his line; up to the minute on modern production methods, and an efficient handler of men. Box 76, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience. "J. A.," Am. Machinist.

Rhode Island

FACTORY ENGINEER, machine and tool designer, demonstrator, speed boss, rate setter, have time studies tabulated; can tune up your plant. Box 60, Am. Ma.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

Agencies wanted by an old reliable company in Copenhagen. Price lists and catalogs wanted. Address F. E. 3042, Wolff's Box, Copenhagen, Denmark.

For Sale—Friction pulley and universal grinding attachments patent for sale; also Canada patent outright. For full particulars address R. Rosner, Madison, Wis.

"Mechanics for Everybody," the 50c. monthly, is making a limited $1-worth-for-50c. offer. Send for sample copy. Agents wanted. Caxton Building, Cleveland, Ohio.

One vertical milling machine, second-hand B. & B. of 5-B size wanted, or similar machine would answer; name price and condition and attachments. Address "N. P. M. Co.," Am. Machinist.

Largest cutter and drill maker in the United Kingdom, with large works and show rooms, desires few good sole agencies, such as micrometers, center drills, ball bearings and kindred lines. Box 22, Am. Machinist.

Draftsmen, mechanics, engineers, draw an ellipse by quick new method; instantaneous; accurate; any size; 50c. postpaid; worth fifty times cost; if not pleased will refund money. B. F. Crawford, L. Box 334, Brazil, Ind., U. S. A.

For Sale—One 100,000-lb. hydraulic testing machine for determining tension or compression; complete with pump, accumulator and scales; built by William Sellers & Co., of Philadelphia. Address The Pope Manufacturing Co., Hartford, Conn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

For Sale—A prosperous machine metal working and tool plant; equipment complete, including wood-pattern department; excellent location in N. Y. City and a going business; will require about $15,000; will deal with principals only; excellent reason for selling. Earl A. Bowman, 416 Broadway, N. Y. City.

For Sale—Rivet machines, second hand, good condition; one No. 4 Mossburg & Granville 400-lb. drop hammer, perfect condition; one new Webster & Perks 4-spindle automatic bolt threader, never used; no reasonable offer refused. Address Philips Pressed Steel Pulley Works, 4th & Glenwood Ave., Philadelphia, Penn.

Machinists—Do you want to earn a day's pay during the noon hour? We are offering big inducements to hustlers in every machine shop in the country; a bonafide business proposition; no triflers need apply; write for particulars. Alert Tool Co., 221-223 N. 23rd St., Philadelphia, Penn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

S. D. Rider, general manager, South Bend Watch Co., recently told how the advertising of the "Big Ben" clock was started, how the advertising manager co-operated with the shop superintendent. It's a lesson that a good many of us could profit by.

"We advertise in order to decrease our cost of production," he said.

"If advertising will stabilize our product and decrease our direct selling cost, why will it not decrease our cost of production?

"Increased production ultimately decreases the cost of production in every manufacturing concern in existence. By increasing our volume of business, selling prices are cut down, and therefore our cost of production.

"The superintendent of production of any manufacturing plant in this country is just as vitally interested in the advertising that the concern is doing as is the advertising manager, because both are dependent upon the successful marketing of the article produced and which must be done in quantities, and expeditiously.

"The advertising manager should go to the general manager and say: We spent for advertising last year a certain per cent. of our sales, which shows a decreased selling cost as compared with former years. Next year my plans call for the expenditure of a larger amount, but this expenditure will assure us of a volume of business that will enable us to reduce our percentage selling cost, and also to decrease cost of production per unit.'

"There are splendid opportunities for the concern that is considering the getting out of any new product by making an earnest effort to add features that will appeal to the buying public in a rightly written advertisement.

"A certain new article was designed by the advertising manager and production superintendent jointly. I refer to BIG BEN. About two years ago G. A. LeRoy of the Western Clock Co., La Salle, Ill., conceived the idea of getting out an alarm clock that would be different from the ordinary cheap article, and around which an advertising campaign could be worked out that would bring results that heretofore have been considered impossible in this line. They work studiously on the matter, until they were finally satisfied that they had a clock that would do all they claimed, and around which could be built an advertising campaign that would astonish the advertising world.

"The work was all done quietly, but with great thoroughness. Big Bens were made by the thousands, copy was prepared and contracts placed for space. Salesmen were educated and advertising helps for the dealer gotten out, and on Sept. 1st, 1910, the first gun was fired. Previous to that time, not a Big Ben was on the market. Today there have been distributed more than 750,000 Big Bens, and they have added to their list of customers 16,000 jewelers, and the end is not yet. This marvelous result has keen accomplished with the much despised alarm clock to work with.

"How and why? Painstaking care in looking after all the intricate details of advertising and selling, a thorough knowledge of how to advertise and the enthusiastic belief in its ultimate success.

"I believe Big Ben has set us all thinking, and speculating as to the possibilities of advertising as a necessary adjunct to any manufacturing business, and especially when the superintendent of production and the advertising manager work hand in hand from the time when the making of the article is conceived until it is placed in the hands of the consumer."

* * *

Only reliable products can be continuously advertised.

Methods in the "Katy" Railway Shops

By F. A. Stanley

Turning tumbling shaft bearings and rocker arm bosses in the horizontal boring mill and under the driller. Reseating throttle valves, and machining driver boxes and brasses.

Engine lathe and turret tools for finishing metal packing, turning bolts, and machining other parts.

Other tools for shoe and wedge operations, and for machining connecting rod brasses.

The halftone and line engravings illustrate some further operations at the Parsons shops of the Missouri, Kansas & Texas Ry., whose use of pneumatically driven devices of various kinds formed the subject of a recent article in these columns.

Fig. 1 represents the method of turning bearings for tumbler shafts on a horizontal boring machine. The table is dropped sufficiently to clear the work and the turning tool is carried at the top of an upright with a flanged base, which is secured by straps to the table.

The work is placed between centers and rotated by a long driver, slotted at the end to receive a block, by which the end of the arm on the shaft is secured for operation.

Another awkward piece—a rocker arm—is held on the driller table, as in Fig. 2, while the boss is turned to size by a hollow mill. This mill is formed with two stiff wings, which receive the inserted blades, and the cutters, as well as the pilots, are readily changed to suit the work in hand.

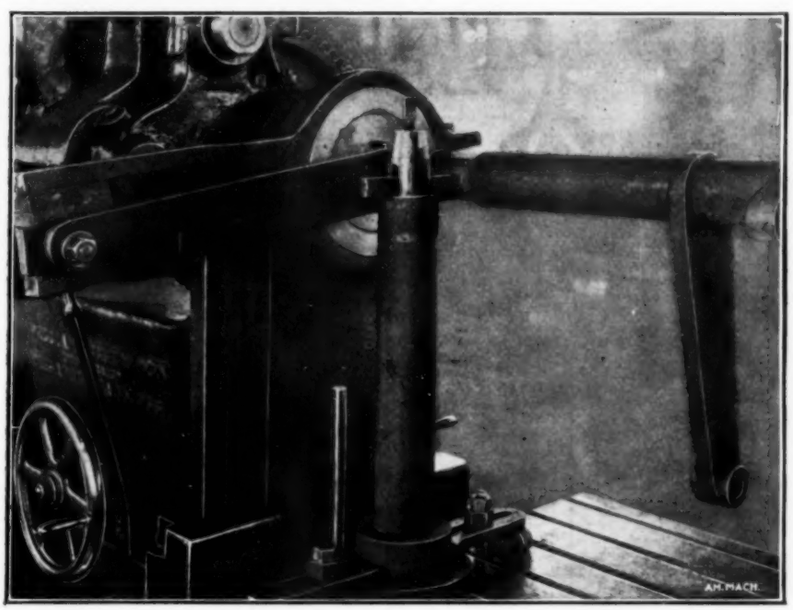


FIG. 1. TURNING TUMBLING SHAFT BEARINGS IN THE HORIZONAL BORING MILL

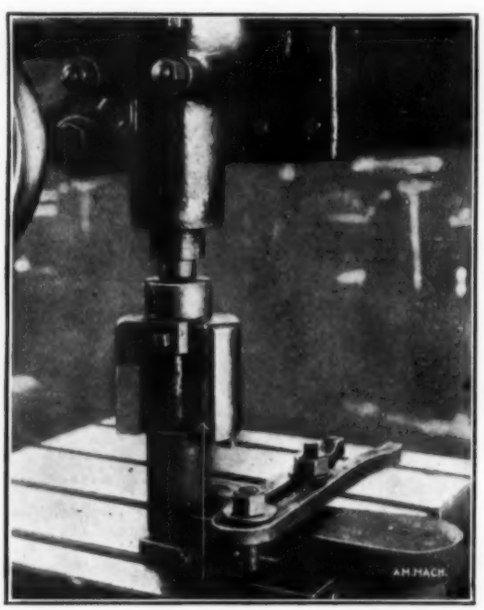


FIG. 2. HOLLOW MILLING ROCKER ARM

THROTTLE OPERATIONS

Fig. 3 shows a reseating tool for throttle valves. The throttle box is secured under the driller spindle, and the double tool run down to form a new surface for the valve to seat upon. The two bevel cutters are accurately spaced by the intervening collar to finish the two seats in the throttle box at the proper distance apart. Both cutter heads are provided with rectangular openings, in which facing cutters may be placed, so that when the bevel cutters have eventually worked below the upper faces of the valve seat, the flat faces may be surfaced off. This prevents a seat from ever becoming so deep that the valve drops below the top of the conical surface and becomes improperly seated.

The valves are ground in as in Fig. 4, by means of a universal drive from an air motor, carried by an "old man" on the bench. The grinding mixture is placed in the joint and the motor does the rest, the valve being lifted at intervals to start at another point in the grinding in to the seat.

SLOTTING DRIVER BRASSES

In Fig. 5 a fixture is shown for holding driver brasses on the slotter for the machining of the exterior to suit the box. The brass is set upon three square-head plugs in a disk, which is central with the slotter table, and which is rotated by hand in adjusting the work for the cut. The disk is then clamped to the table and the power rotary feed employed to revolve the brass past the slotting tool.

A setting templet is used in connection with this operation, which may be used in scribing the top of the brass, and which facilitates the process of locating the work properly under the tool.

Another slotter fixture is represented by Fig. 6, which shows a block with converging sides, into which an eccentric may be slid for slotting. The V-form of the fixture centers the work in relation to a table slot, and the same slot locates a setting gage for the slotter tool. Thus, there is no reason for the tool to be put into operation off center.

DRIVER-BOX FACES

The method of providing a lateral bearing on driver boxes is shown in Fig. 7. This bearing face is made up of brass-head plugs and babbitt. A channel is formed in the face of the box, and holes are then drilled and counterbored for the plugs, as seen at *A*. The large-head brass plugs are then driven in as at *B*, and the channel filled with babbitt. When the box is faced off it presents the appearance indicated at *C*.

A HOME-MADE TURRET

Fig. 8 illustrates a turret made for use on the compound rest of a lathe, where it facilitates the finishing of valve parts, and many other pieces.

This turret has a rectangular block at the bottom for fitting directly in the tool-post slot in the top of the rest. The

index device is a plain rectangular bar, which enters narrow slots in the under side of the turret. There is also a taper locking pin, which fits into holes under the turret. The lever and pin are held up into engagement with the turret-indexing openings by a spring inside the turret body.

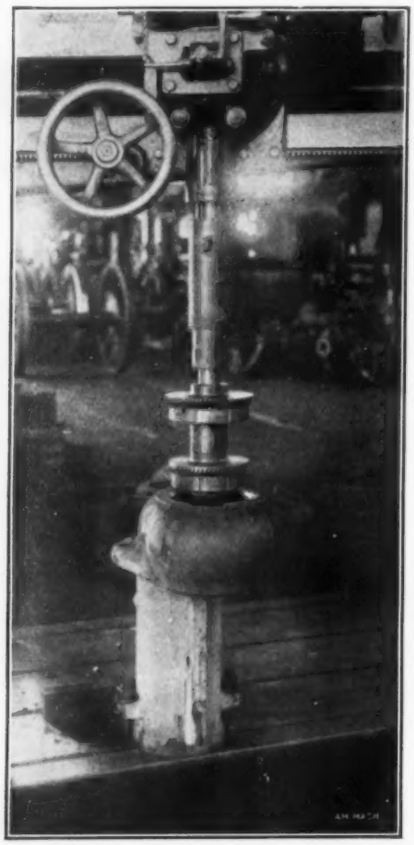


FIG. 3. RESEATING THROTTLE BOXES

Several interesting tools are used in connection with this turret. One of these is a boring bar, shown just in front of the work in Fig. 8, and seen more clearly in the sketch at *D*, Fig. 9. This bar is hollow from the shank to the outer end, the end is plugged and an opening is formed at an angle for the boring tool. A rod behind the tool is forced forward by a taper key placed crosswise through the shank, and the tool is thus held securely, after adjusting as desired.

A LONGER BORING BAR

Another form of boring tool, held by a block on the compound rest instead of in the turret, is shown at *E*, Fig. 9. The bar in this case is hollow from end to end, and the front end is plugged and provided with an oblique slot for the single-point tool, as in the other construction. The tool is clamped, however, by a setscrew at the rear end, which is tapped into the hollow bar and acts against the long rod, whose beveled inner end presses against the cutter.

Both of the bars illustrated are made in various sizes and lengths to suit different classes of work. The block which holds the bar *E* is secured to the tool rest of the lathe by slipping it over the regular tool post, placing a lathe tool in the slot of the post and across the top of the block, then tightening the tool-post screw.

CHUCK FOR FINISHING METAL PACKING

A chuck for holding metal packing to allow the exterior to be formed is illustrated by the sketch, Fig. 10. The chuck body *A* screws onto the nose of the lathe spindle and has a reduced portion at the outer end, which carries three expanding jaws *B* for holding the packing rings by the bore. The jaws are provided with a rounded projection on the inner edge, which rests against the tapered portion of the operating plug *C*, passing through the center of the chuck. The taper surface is formed with a series of shallow grooves around the circumference, and the projections on the jaws engaging these depressions prevent the taper plug from accidentally sliding end-

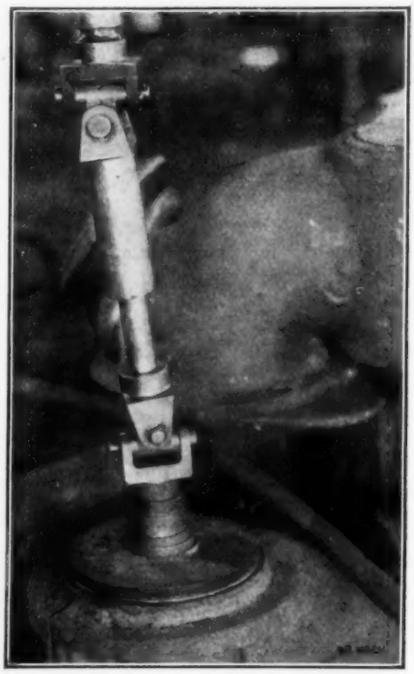


FIG. 4. GRINDING IN THROTTLE VALVES

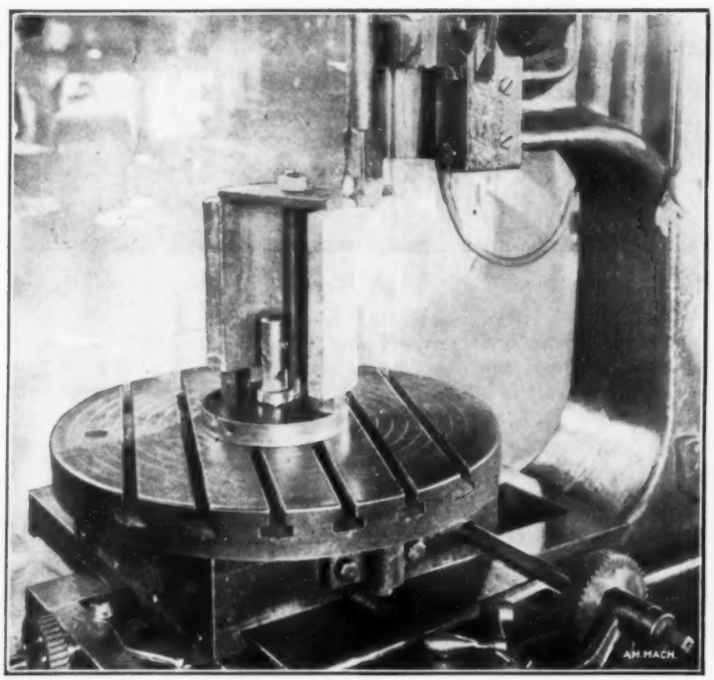


FIG. 5. MACHINING MAIN BRASSES IN THE SLOTTER

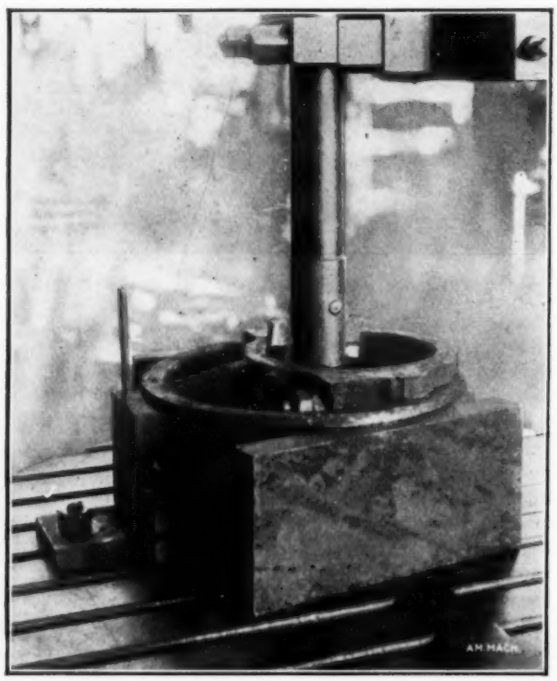


FIG. 6. ANOTHER SLOTTER OPERATION

wise and releasing the jaws when they are expanded in the work.

The chuck is operated by the external ring *D*, which slides along the chuck body, the ring being actuated by a lever and yoke, which engages the groove *E*, formed around the ring. A pin passing crosswise through the chuck connects the operating ring with the central plunger *C*, so that when the operating lever is moved sidewise the plunger travels with it and grips or releases the work.

FIG. 7. FORMING DRIVER BOX FACE OF BRASS AND BABBITT

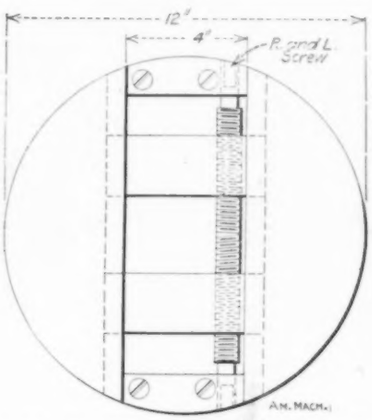


FIG. 11. CHUCK WITH FLOATING JAWS FOR DRIVING ROUGH BOLTS

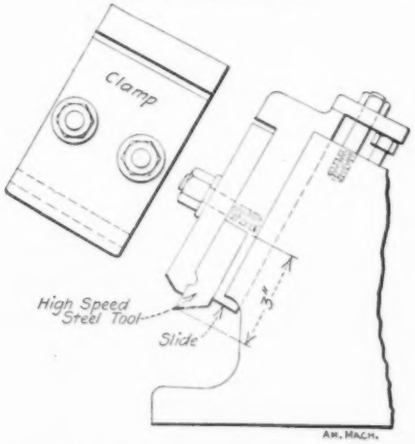


FIG. 12. METHOD OF HOLDING FORMING TOOL IN BLOCK

ANOTHER CHUCK

A chuck is illustrated in Fig. 11 for driving such work as square-head bolts (or bolts with other shapes of heads), which are placed on centers and loosely held between the chuck jaws. The latter are closed by a right- and left-hand screw and have a floating movement of about one-half inch to and fro in the slot across the chuck, the screw having that amount of end play between its bearings at opposite sides of the chuck.

HIGH-SPEED STEEL FORMING TOOLS

The flat forming tools used in the turret-lathe tool block, Fig. 12, are made quite short, and the former method of providing them with a dovetail to fit the holder has been superseded at this shop by an arrangement consisting of a dovetailed slide, in which the tool is secured by a substantial clamp. Thus considerable saving is made in high-priced steel, and the making of the tool becomes a simpler proposition.

The lower end of the clamp is formed with a beveled rib, extending the full width at the under side, and this takes a bearing against a sloping groove across the face of the forming tool, so that the tool is drawn back against its abutment when the clamp is tightened.

FIXTURE FOR SHOES AND WEDGES

A long fixture for planing shoes and wedges is shown in Fig. 13. The fixture has a guide along the top for the work and slots at either edge for the blocks that carry the clamp screws. The latter are adjustable along the fixture to suit the length of the work, and the screws tapped up through the fixture under the work are spaced to accommodate the different wedges.

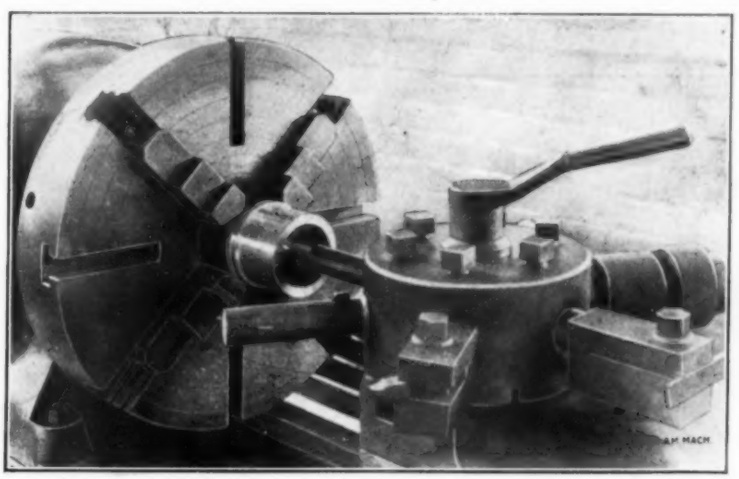


FIG. 8. HOME-MADE TURRET ON THE COMPOUND REST

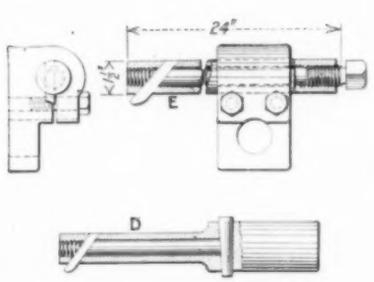


FIG. 9. BORING TOOL HOLDER

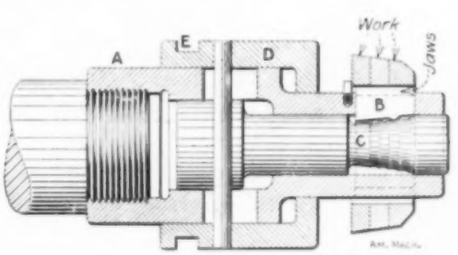


FIG. 10. CHUCK FOR HOLDING PACKING RINGS

A ROD-BRASS FIXTURE

The fixture in Fig. 14 is used for finishing rod brasses, and is provided with an index plate for locating the work correctly for shaping the bearing surfaces around the edges.

When the brass is secured to the spindle of the fixture, and the index locked, the adjustable wedge is set up under the work to hold it rigid during the cut. The wedge has a quick adjustment along the serrated block at the bottom, and after it is pushed up the incline into contact with the brass, the adjusting screw is turned to bring it snugly to place It is a simple matter as fast as each side is finished to withdraw the wedge, release the index and set the brass for the shaping of the next face.

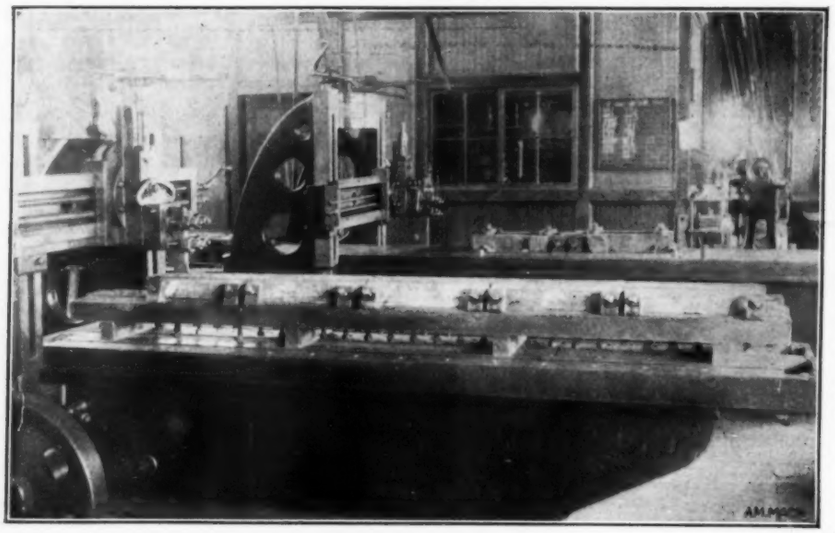


FIG. 13. PLANER FIXTURE FOR SHOES AND WEDGES

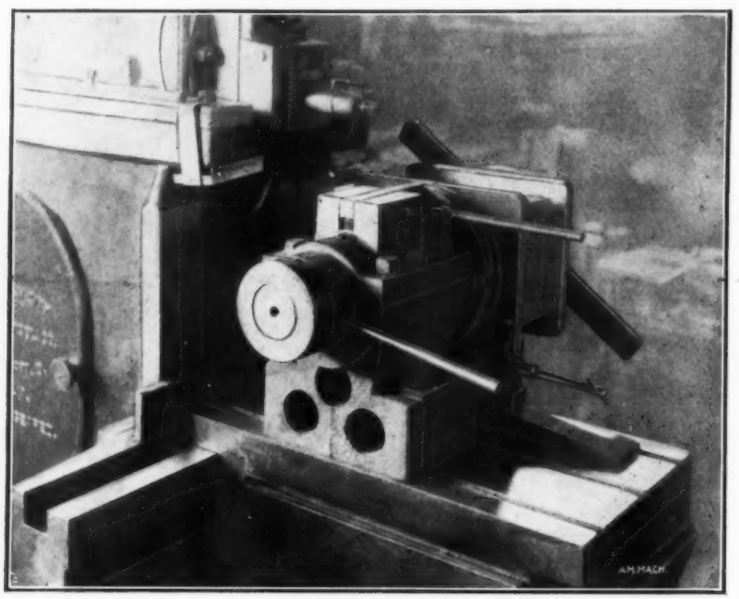


FIG. 14. AN INDEXING FIXTURE ON THE SHAPER FOR ROD BRASSES

FIG. 15. CAP FOR CASTLE NUTS

A NUT TAP

A tap for castle nuts is shown in Fig. 15. This is made with the back of the tap unfluted, so that when the tap is run through from the back of the nut, the rear portion forms a guide, which prevents the tap from jumping and catching in the castellations as it passes out at the front of the nut.

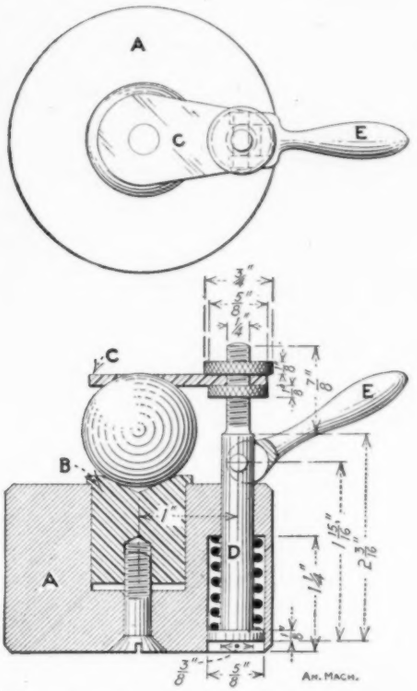
Scleroscope Attachment for Testing Balls

BY J. M. HENRY

The balls for the higher grade of ball bearings are subjected to tests as to hardness in the same manner as the outer and inner rings.

It is very hard to get the scleroscope to register accurately on round pieces of material even when a flat surface is ground on them. The device shown in the diagram was designed to hold the balls in absolute alignment with the scleroscope cylinder and "dropper."

The base *A* is cast iron reamed out as shown for the anvil *B* and the holding-post *D*. A set of anvils *B* is needed to take care of the various sizes of balls. They are made of tool steel, a close sliding fit for the base *A* as noted. A set of holding straps *C* is also needed to match the anvils.



SCLEROSCOPE ATTACHMENT FOR TESTING BALLS

In using the device the ball to be tested is placed on the anvil *B*, and the strap *C* adjusted by means of the check nuts. The eccentric handle *E* and the holding-post *D* need no further explanation. The device is centered under the scleroscope cylinder in the usual manner.

The growth and changes in distribution of our exports of iron and steel manufactures during the last decade are well illustrated by the following comparative figures. The exports to Europe in the fiscal year 1901 were 44 million, in 1911, 51 million dollars; to North America, in 1901, 44 million, in 1911, 107 million dollars, the growth in exports to Europe being slight, while those to North America more than doubled. To South America the figures for 1901 were 9 million, those for 1911, 30 million dollars; to Asia, 9 million in 1901, 18 million in 1911; to Oceania, 9 million in 1901, 19 million in 1911; and to Africa, 3½ million in 1901, 5½ million in 1911.

Data on Taps and Tapping*

By H. E. Harris†

The effect of size of hole, of shape of tap flute, number of cutting teeth, tap diameter and lead, and the lubricant used.

Valuable tables showing power required for tapping with different lubricants and different taps.

*Presented before American Society of Mechanical Engineers in New York, Mar. 12, 1912.

†Engineer of tests, Wells Bros. Co.

The average user of machine screws and bolts cares very little about the fine-drawn theories in regard to angles and other details and their practical application to tap and die making, but he must be intensely interested in being able to buy or make screws and bolts which can be depended on to fit the tapped holes in whatever product he may be making.

Realizing that there is no such thing as perfection, certain allowances for errors must be made. These errors, however, must be confined to such small limits that the smallest permissible diameter for the taps must be slightly larger than the largest permissible diameter for the screws. If these limits are too large, a screw which happens to be used in a hole tapped by a maximum-sized tap may be too loose, so that the limits must be closely guarded, but at the same time, they must not be so small as to prevent assembling interchangeably, or a reasonable amount of wear on the taps.

The two most vital factors which have to do with this are the size and the lead. Before we can talk very intelligently about the size, we must understand how this is to be measured. The fit of any screw should be on the sides of the angle of the thread, as the outside and root diameters have comparatively little to do with the actual fit. Unless the angle and the lead of the threads are the same in both screw and tapped hole, and the diameters measured across the angles of the threads are relatively right, a proper fit cannot be obtained, no matter how close to size we hold the outside and root diameters.

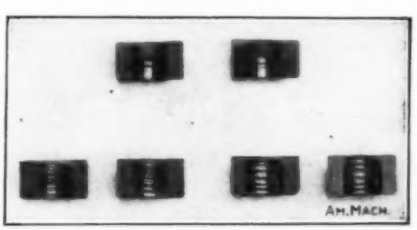


FIG. 5. REAMING EFFECT OF TAPS

One effect of having nuts and screws of different angles fitted together is shown in Fig. 1. In this case the screw is shown with a more obtuse angle than the nut, and the bearing between them, if we were fortunate to get a bearing this way, would be on the sharp, fragile apices of the teeth.

The necessity of accurately measuring in the angle has led to the adoption of the term "pitch diameter" for screw threads, the same as for gears, and those who have carefully gone into the study of screw threads are using this method of measuring almost exclusively. Fig. 2 shows a micrometer which measures these important diameters across the angle. The great merit of this tool is that it is not rendered inaccurate by the helix angle of the thread; that it will measure the finest lead thread as well as the coarsest within its range.

In Fig. 3 is shown how variations in the lead will effect the pitch of a screw. The angle in this case has been assumed to be correct, but the nut has been tapped with a tap having a long or stretched lead, with the result that at best a bearing can be had only in two places, as indicated by *AD* and *BC*.

This is not by any means an exaggerated condition and explains the reason why a nut, tapped with a large enough tap, will often start freely on a screw, turn a few turns and gradually bind. It has then found its *AD* and *BC* and cannot move further, because the bearing being on opposite sides of the thread acts as a wedge.

While it is possible that on small work, and with soft metals, screws might be put together in this way, it is very evident that it would not be a good job, and that it would very soon be unsatisfactory. It would also tend to place all strain on one tooth at a time, making it possible, under a longitudinal strain, to strip one tooth after another with a shearing action at a small percentage of the power that would be required when the lead is correct.

DUPLICATE SCREWS IN ASSEMBLY

Those who do a large amount of assembling, when thousands of screws of various sizes are used, know the difficulty of this proposition. They know too well the variation to be found in machine screws, as well as in the tap holes, and the delay which this makes in assembling, as well as the difficulty of supplying duplicate parts. For this reason, many are using limit gages which are especially made to measure the screw diameters across the angles, and so insure the uniformity within working limits, of the screws to be used.

The rapidity and accuracy of this method is partly apparent, but its great efficiency will be realized better if actual figures are given. An inspector of ¼-in. taps for limits on angle, and for outside diameters, with two limit gages of this style will gage about 750 per hour. For ordinary screw work, not requiring such extreme care, the output would be greater.

Considering the lead, there is little doubt that most makers use a somewhat similar method to secure uniformity of product. It must be remembered, however, that as all steel expands and contracts with heat and cold, taps change their lead to some extent in the hardening process. If, in addition to this, they are warped on the threaded end, both the lead and diameter of the tapped hole will be affected, as can be seen in Fig. 4. The relation of the tapped hole to the stand-

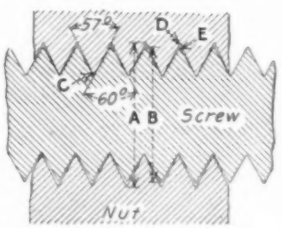


FIG. 1. EFFECT OF WRONG WAY

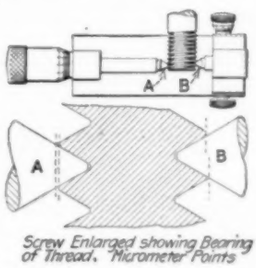


FIG. 2. MEASURING PITCH LINE

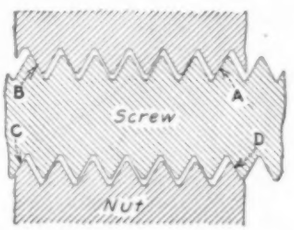


FIG. 3. INCORRECT LEAD

FIG. 4. EFFECT OF WARPED TAP

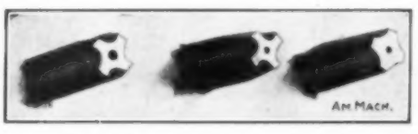


FIG. 6. THREE SHAPES OF FLUTES

ard thread portrays the actual result obtained with a warped tap.

The Question of Correct Limits

Now we have seen the effects that errors in lead, angle, angle diameters and warping will have on the taps. Add to this the effect that usage has, that is, to reduce the tap's size by wear, and then add the commercial variations of lead, angle and diameter in the screws or bolts and it will be readily seen under the best possible conditions that there will be a multiplicity of minute errors that will have to be taken care of by the allowance between the minimum limit of the tap and the maximum limit of the screw. There will also have to be a maximum limit set on the tap, and a minimum limit set for the screw, to provide for manufacturing allowances and to prevent too much looseness in the fit of the threads.

There is a great diversity of opinion at the present time among tap and die makers and screw makers in general, as to what these allowances should be and what constitute the correct limits for the taps and screws of the U. S. Standard sizes. As a consequence the buyer or manufacturer has trouble in buying taps to suit his screws or screws to fit his tapped holes, and is working under a serious handicap in his efforts toward proper fits and interchangeable work.

Your committee in 1907, on the Standard Proportions of Machine Screws, after considerable investigation and painstaking care, turned in an admirable report. It contained a list of standard machine screw sizes with diagrams and tables of standard proportions, limits for screws and taps, sizes of references, gages, etc., which received the endorsement and has been of unlimited value to the industrial community at large. However, this leaves us still with the question of limits for the larger size screw threads unsettled. This question, from its far-reaching nature, is much too large a matter to be settled by any one concern—whether tap and die maker, screw maker, or user—and we earnestly hope that the discussion of this paper will lead to the settlement and adoption of standard U. S. S. tap and screw limits, or proportions.

Blaming the Tap Maker

Whenever taps break, or anything goes wrong, it is probably the most natural thing in the world to blame the tap maker.

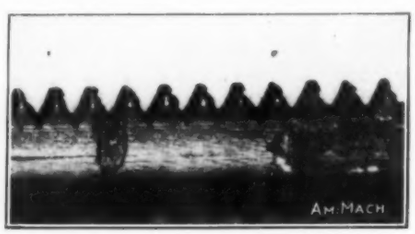
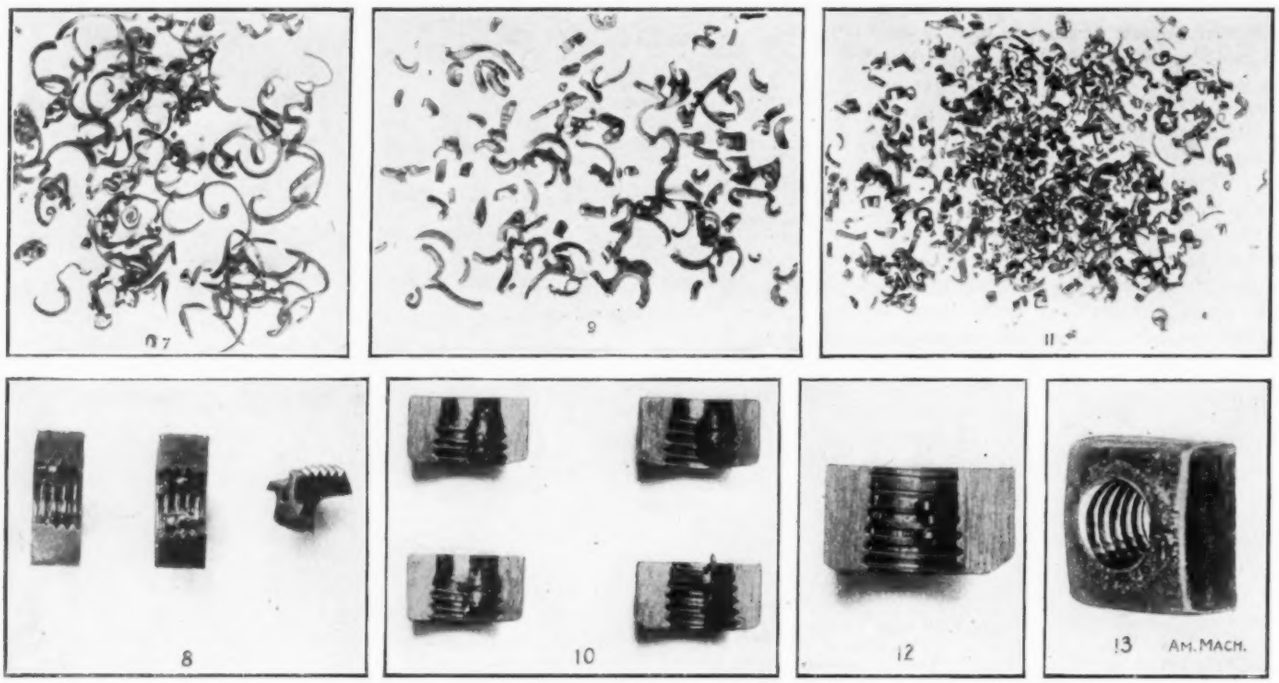


Fig. 14. Burrs on Cutting Edges of Taps

In many cases, however, it is entirely due to the conditions under which the tap has to work.

In order to determine some of these practical points, such as proper sizes of tap drills, the best lubricants, the correct cutting angles and shapes of flute, the right number of threads among which to distribute the cutting, the best methods of tempering to increase the life and strength of taps, the proper way to grind the cutting edges, etc., we have had special testing machines built, which show the power required to drive any tap within their several capacities, and which record the tap's cutting action on graphs or charts.

We often find, in cases where we would least expect it, that a manufacturer is actually punching or drilling tap holes to a smaller diameter than the root diameter of the thread, so that the end of the taps must act as a reamer before a thread can be cut.



Important Considerations in Taps and Tapping

Three stages of this reaming are shown in Fig. 5. In this case the tap becomes a taper reamer with unrelieved chip breakers, and reams a taper entrance to the hole, as shown in the nuts at the top. It will often fail to "catch the thread" at all, and will, therefore, ream clear through or to the bottom without threading, as shown in the two nuts at the right. Or, if the thread does happen to "catch" after reaming part way through, we have a short, weak thread, as shown by the two nuts at the right.

Tap-drill Diameters

This requires considerable power, even beyond the breaking strain, and explains why taps sometimes refuse to cut a thread at all, and also why taps sometimes break almost as soon as they begin to cut. When it is remembered that, generally speaking, more than 80 per cent. of the standard thread depth is never necessary in manufacturing, even for shallow holes, and in many cases not more than 50 per cent., we can see the folly of having holes

too small, and in most cases of even attempting to secure a full thread.

Tap-drill sizes for machine screws, in particular, should be varied according to the material to be tapped, and the depth of the tapping. Roughly stated, for holes that have the screws enter more than 1½ times the diameter, 50 per cent. or half thread is usually sufficient, as the head or shank of the screw will twist off before the thread will strip.

Soft, tough material, such as copper, Norway iron, drawn aluminum, etc., should have a larger hole for the tap than the harder and more crystalline materials, such as cast brass, iron and steel. This is because, if they are drilled smaller, the tops of the threads will likely be torn off, which decreases the effective depth of the thread in the tap hole, and results in a poorer thread than if the hole had been originally drilled a little longer.

On the other hand, in these more tenacious, ductile materials, if the hole is originally a little large, the tap will, especially after the keen edge has become slightly dulled by use, reduce the size of the hole by a spinning or drawing of the metal at the tops of the threads, thereby increasing the effective depth of the thread.

It should also be remembered that it is impracticable to tap a hole with the basic root diameter size, unless the much slower process with serial taps, or long step taps, is used, so as to divide the tapping operation into a series of successive steps, each removing a small amount of metal. The size of the hole also affects very materially the power required for tapping, and the tap breakage. This is particularly important in machine tapping, which is the main thing to be considered in manufacturing. The power is also affected by the kind of lubricant used, by the condition of the tap—sharp or dull—the shape of the cutting edges and the shape and action of the chip, and also by the chip clearance.

Effect of Shape of Flutes

In Fig. 6 are shown three taps with different fluting. The tap at the middle produces a long curling chip, which, in a deep hole, would have sufficient length to curl up tightly, jam the tap and cause the tap to twist or break off, if there were sufficient driving power. The chips are shown in Fig. 7; note the length, the curled, twisted form and the large percentage of tightly curled chips.

The nuts in which long curled chips have rolled up and broken the tap are seen in Fig. 8; note, however, the clean, smooth thread. In Fig. 6 the tap at the right tears and pushes the metal ahead of it, often accumulating enough compressed, unseparated metal to resist further compression and break the tap. This tap broke while tapping cold-punched nuts, 1100 inch-pounds, twisting off near the shank in spite of the fact that the work was divided among 48 cutting teeth. The chips from this tap are shown in Fig. 9. Note their compressed character; in fact, they show by their appearance the relatively large amount of power required and increased breaking strain on the tap.

The sections of four nuts tapped with this kind of tap, and in which the taps broke, are illustrated in Fig. 10. Note the compressed and mashed-together mass of metal adhering to the thread, and the torn condition. When four of these obstructions accumulate in one tapped hole, the tap is apt to give out.

The tap shown in Fig. 6 not only cuts a free, slightly curling chip, but will break the chip into short lengths that will readily slide out of the way along the flutes when pushed along by the successive chips, or carried along by the lubricant. On an average it uses about one-third of the power that the tap on the right does.

The chips cut by such a tap are shown in Fig. 11. They are free-cutting and short, and the tap works under a much less strain than with the other forms of fluting, as continued tests with different forms and in various metals have proved.

A section is shown in Fig. 12 of a nut in which this last style of tap was started, after which the nut was cut open to show the action of the chip. Note the smooth thread and clean, short curl on the chip, which was on the point of breaking.

Taps Used, ½ In.—13 U. S. Standard. Root Diameter of Test Pieces 0.420 In. Depth of Tapped Hole, ½ In.

Materials Used	Test numbers of taps													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hexagon drawn brass	60	62	62	60	65	70	60	90	60	60	60	60	60	65
	65	60	65	60	65	80	60	95	62	60	60	62	65	65
Crucible tool steel	220	242	250	230	240	280	250	375	210	270	260	270	260	258
	225	265	268	250	230	260	235	380	205	280	275	260	260	270
Cold-punched hexagon steel nuts	148	158	168	170	155	150	150	340	165	195	165	175	148	180
	130	130	175	190	160	180	132	360	140	160	225	200	180	180
Hexagon screw stock	140	150	165	188	178	180	155	250	140	240	235	168	225	230
	160	170	185	165	210	268	170	430	155	190	200	160	205	205
Drawn hexagon phosphor-bronze	210	175	250	200	230	240	170	338	160	200	220	222	265	210
	190	200	300	250	200	250	182	320	190	330	210	245	205	210

TABLE 1. SHOWING VARIATIONS IN THE ACTION OF TAPS IN DIFFERENT MATERIALS

Dividing Up the Work

As almost all machine tapping is in through holes, and the uses of the bottoming tap are extremely few, we have experimented with the effects of sharpening or grinding the taps back from the end for a varying number of threads, so as to ascertain the effect of dividing the work among more or less cutting teeth. We have found by repeated tests and careful record, that it requires approxi-

Lubricant	Animal Lard Oil	Sperm Oil	Graphite, 10% Tallow, 90%	Cataract Soap Compound	Mineral Lard Oil	None	Machine
0.425 In. Diameter of Tap Hole. 75% Thread							
Per cent. of breaking strain	15.9	16.5	16.9	18.9	19.9	29.9	34.2
Breakages in tests	none	none	none	none	none	14%	15%
Quality of thread cut	smooth	smooth	smooth	smooth	smooth	rough	torn
0.410 In. Diameter of Tap Hole. 90% Thread							
Per cent. of breaking strain	....	23	....	25.1	36.5	60.2	68.5
Breakages in tests	....	none	....	none	none	59%	71.5%
Quality of thread cut	....	smooth	....	smooth	smooth	rough	torn badly
0.400 In. Diameter of Tap Hole. 100% Thread							
Per cent. of breaking strain	....	35.5	....	41	57.5	71.8	100
Breakages in tests	....	none	....	none	none	66%	100%
Quality of thread cut	....	Smooth, but with tops torn	....	Slightly rough, tops torn	Smooth, but with tops torn	Torn and partly stripped	Torn and wedged, so as to prevent tap cutting through

Note—By multiplying the above percentages by 10, the actual average power required in inch-pounds may be obtained.

TABLE 2. SHOWING EFFECTS OF VARIOUS LUBRICANTS AND DIFFERENT TAP DRILL DIAMETERS ON THE CUTTING ACTION AND BREAKING OF TAPS

mately 25 per cent. more power to drive a tap which has been ground back but four threads, and which, in a four-flute tap, divides the cutting among 16 teeth, than for one which has been ground back six threads and has 24 cutting teeth. The 24 cutting teeth also gave much smoother threads, and cut much closer to size. This shows that for general use a tap ground six threads works better and will last longer than one ground back only four.

In Fig. 13 is shown a very badly chattered nut. This is caused by burrs thrown up on the cutting edges of the tap during its manufacture. This has an effect on the cutting action of the tap similar to what relieving or backing off the threads would have, that is, it cuts large and rough, and jumps from side to side.

A magnified view of these burrs is shown in Fig. 14. This shows the necessity of having taps free from burrs. Great attention has to be paid to this point in order to produce good taps. The effect that different materials have upon the power required for tapping is shown in Table I.

These values represent the power required in inch-pounds to drive the taps through the test pieces, as measured on the testing machine. It will be seen that drawn brass required, on the average, 65-inch-pounds, and is very uniform, and that while crucible steel is also a uniform cutting material, it required an average of 261 inch-pounds. Cold-punched hexagon steel nuts required an average of 190 inch-pounds; and hexagon screw stock tapped endwise, 197 inch-pounds. Phosphor bronze shows the biggest power variation for the same tap, or throughout the test. It required an average of 228 inch-pounds.

Taps Nos. 6 and 8 had a slightly poorer form of flute than the rest, and did not cut as smoothly nor as easily, as may be seen by referring to the power readings given in the table.

Table 2 shows the effects of varying the root diameters and using different lubricants.

Effect of Lubricant on Size and Power

This table, which is the final result of a long series of tests, shows that the power required to break a properly made ½-in. 13 plug U. S. Standard is approximately 1000 inch-pounds. We take, for comparative purposes, this breaking strain as a 100 per cent. strain, and give the lesser strain required for tapping holes under different conditions, as percentages of this. The test pieces used were common hexagon cold-punched nuts, accurately reamed to the respective sizes, and the taps used were regular stock ½-in. 13 U. S. Standard taps. The points which this series of tests particularly seem to emphasize are as follows:

First. That the lubricants used, up to a certain point, have the same effect on the cutting power required as more or less metal to remove would have. For instance, to tap a ½-in. nut with a 0.425-in. tap hole, using machine oil instead of sperm oil, would have practically the same effect on the power required as reducing the diameter of the tap hole 25 per cent. of the double depth of the thread.

Referring to the table, it will be seen that the power is approximately doubled in both cases; 16.5 per cent. to 34.2 per cent. changing from sperm oil to machine oil, and 16.5 per cent. in the sperm-oil column, changing from 0.425-in. to 0.400-in. tap drill hole.

Second: That animal lard oil, sperm oil and graphite and tallow mixture are the best lubricants of those tested.

Third: That a good soap compound is better than mineral lard oil for the purpose of tapping.

Fourth: That machine oil is a detriment instead of a help; that taps cut better dry than with it.

Fifth: That the number of breakages can be greatly reduced by the use of a proper lubricant and that taps should never be used dry, in steel.

Sixth: That the diameter of the tap drill hole should not be any smaller than is absolutely needed to give the necessary strength, and that if this requires a full depth of thread on any particular size, it would be advisable, from a tapping standpoint, to gain strength by using instead a larger size of thread, in combination with an oversize tap hole.

Seventh: If, for any reason, it is desirable to produce a thread having the full depth in order to prevent breakage of taps and the tearing of the tops of the threads (which ultimately increases the size of the tap hole), serial taps should be used with the best lubricant obtainable.

Eighth: That every decrease of 0.001 in. in diameter of the tap hole materially increases the power required to tap it, and also increases the percentage of broken taps, and that as the tap hole gets smaller, the increase occurs in a greater ratio.

Referring to the table, it will be seen that the decrease of 0.15 in. in diameter from 0.425 in. to 0.410 in. required only 65 additional inch-pounds in power, or an average of a little over four inch-pounds per 0.001 in., while the decrease of 0.010 in. from 0.410 in. to 0.400 in. required 125 additional inch-pounds increase in power, or an average of 12.5 inch-pounds per 0.001 inch.

It should be said that a very small part of the tapping proposition has been presented. The matter, though apparently a simple one, is in reality so involved that the experiments, tests and developments which have taken place during the last three years would fill a great many papers the length of this one.

In conclusion, the author wishes to thank Fred H. Colvin for his valuable cooperation, also Frank O. Wells, who gave access to the information set forth through the efficient testing department which is maintained at the Wells Brothers Co., and to the files and specimen closets to which he has had frequent recourse.

Photograpic Reproduction of Tracings

Engineers very often find it necessary to have letter-size reproductions of tracings. A very cheap and simple method of making a reproduction is as follows:

Preparing the Tracing—The tracing should be gone over, making all lines and letters opaque. When ready, pick out a window (preferably one facing the north) that is larger than the tracing, so that no shadows will be cast on the edges, and in front of this stretch a sheet of tracing paper or cloth. Over this stretch the tracing to be reproduced, being careful to remove all wrinkles from both diffuser and drawing. If this is properly done the light should be evenly distributed and there should be no shadows.

Exposure—To obtain an idea of the exposure, hold an actinometer, face to the window, and note the time as per instructions. Make about four exposures on a plate by pulling the slide out different distances, using the smallest stop. When developed, if the correct exposure is not within the limits chosen, try again. After the correct exposure has been found, note the relation to the actinometer time. This relation will be a constant and can be applied to all actinometer times to find the exposure, provided the same plate and stop are used.

Developing—A negative with contrast is desired. This may be had by using Cramer's contrast plates and Eastman's Hydrochinone developer. Mix as directed, making the solution weaker if anything, as this tends to give contrast. With the above plate, develop until the image begins to show on the glass side, when, if properly exposed, the plate should be nearly opaque.

Remarks — No special apparatus is necessary. A 10x12-in. box camera with a good lens and a few trays and bottles will do the work. It pays to get good negatives; this is all in the exposure. By using the smallest stop, good definition is obtained, the exposure is lengthened and can be more accurately timed.—G. W. Gilkinson in the *Engineering News*.

A formula which is recommended by a writer in the *Chemical News* for making a good bronze casting, which will keep water or steam under high pressure, is as follows: 78% of Cu and 10% of brass (containing 30% Zn) are melted in a crucible, then 12% of Sn are added and 1.4% of Zn. Finally, 0.12% of Cu-silicon (10% Si) is added.

Manufacturing Plug Gages at Low Cost

By J. P. Brophy*

The principal object of this article is to elaborate more or less upon the manner in which plug gages are manufactured by the Cleveland Automatic Machine Co. It is well understood by superintendents and managers of manufacturing plants who find it is necessary to produce interchangeable parts, that it is essential to place in the hands of workmen the very best tools obtainable. Plug and ring gages are not used as extensively as they should be, owing to their cost.

This leads to a matter of great importance in all manufacturing plants; that of keeping the holes as nearly exact duplicates as possible as to size, parallelism and roundness.

It is the real foundation of present-day manufacturing, because if the holes are not kept as nearly correct as possible, or within 0.0005 in. above or below, it will be noticed, as the parts pass along from one department to anofher that the arbors used on lathes, millers, gear cutters, etc., will be either too large or too small. They must be made more or less tapered, especially for the lathes, and when the piece is forced on the arbor, it fits on one end only.

As soon as this happens you are departing as rapidly as possible from what is considered good workmanship. In other words, it is necessary to have all sizes of arbors and many of them special, because of the negligence in producing good holes, which is really the commencement of the work in the manufacture of parts of all kinds. Drawings are never marked above or below size when giving dimensions of a hole, but if the shafts or spindles that fit these holes are running or pressed fit, they are marked in decimals, above or below size, the necessary amount for the purpose intended.

The frequent use of standard gages is essential if interchangeable parts are to be made but the cost of tool steel gages makes it difficult for many shops to use them as freely as desirable.

The Cleveland Automatic Machine Co. has adopted a system of gages of low carbon steel which they make at a very low cost and check out to the men as freely as any other tools.

The system of making, the cost and the methods of using are given in this article.

*Vice-president and general manager, Cleveland Automatic Machine Co.

Grinding to Exact Size

It will be easily seen from this that if the holes are right, all parts that require grinding can be ground to exact size much in advance if necessary, for the simple reason that the holes are kept close to size. If they vary considerably by allowing the reamers to become small, it is necessary to fit each individual shaft to the piece for which it is intended and to watch the diameter of the hole closely, regardless of the expense of the tools, than it is to have all sizes of holes to contend with.

In case of breakage through accident or otherwise, especially on high-priced machinery, if the part cannot be duplicated without having the broken piece sent to the factory, interchangeable machinery is certainly not being built. It is a detriment to the customer and to the manufacturer when such a thing occurs, but if the practice of keeping the holes right is followed, a great amount of this possible trouble is avoided.

A set of ring and plug gages, where there is any great number required, is very costly, and in a great many factories is considered more or less of a luxury. The advisability of having a first-class set of gages to refer to is not condemned, but where plugs and gages should be used extensively throughout the plant, you are not apt to purchase enough high-class gages to have enough to check out freely from the toolroom the same as any other tool. This is decidedly wrong. For this reason the methods employed in the manufacture and liberal distribution of plug gages will be explained.

Few ring gages are used, as nearly all the spindles and shafts are ground, and the sizes being above or below in many instances, it is necessary to use micrometers. The ring gages are made from the same material as the plug gages.

Five sizes of plug gages, ranging from ½ in. to 2¾ in., which cover a vast range of work, are shown in Fig. 1. It will be noticed that from 1¾ in. to 2¾ in. the gages are all one length and are generally made from stock that will finish 2¾ in. turned down to any size required until the 1¾-in. size is reached. The second size is from 1¼ in. to 1¾ in.; the third, from 1 in. to 1¼ in.; the fourth, from ¾ in. to 1 in., and the fifth, from this down to ½ in. or even smaller.

Setting Up the Machine

If the sizes required range in between the dimensions given above, all that is necessary in setting up the machine for blanks is to change the chuck and feed shell pads. And when these are set up for making these blanks for any size required, it would not be necessary to alter the tools in any respect. You could change the chuck jaws in perhaps 15 minutes.

For instance, if you wanted blanks made from a bar, say 2¼ in. diameter, which is half way between the largest and smallest sizes named, you could produce them, of course thereby saving more or less material. The same applies to all the other sizes. To sum this whole matter up, if you were commencing to make gages of the sizes mentioned, 10 different diameters of bars might be used, producing five different shapes. This would perhaps be the best in the first place, but after making the first lot of 100 each, then any size plug that might be worn down below standard could be annealed and turned down to the next size.

The object is not to have too many sizes of blanks. If the sizes were graded from large to small, we would have a

Fig. 1. Five Sizes of Plug Gages Ranging from ½ to 2¾ in.

different length and diameter of knurled part and body for each size and so increase the cost of manufacturing these gages. The most startling statement in connection with this whole matter is that these plug gages are made from ordinary machine steel; in other words, screw stock of about 12 points carbon. Undoubtedly many readers will disbelieve that a plug gage made from machine steel could possibly be of any consequence, but tests made long ago resulted in the successful manufacture and use of these gages.

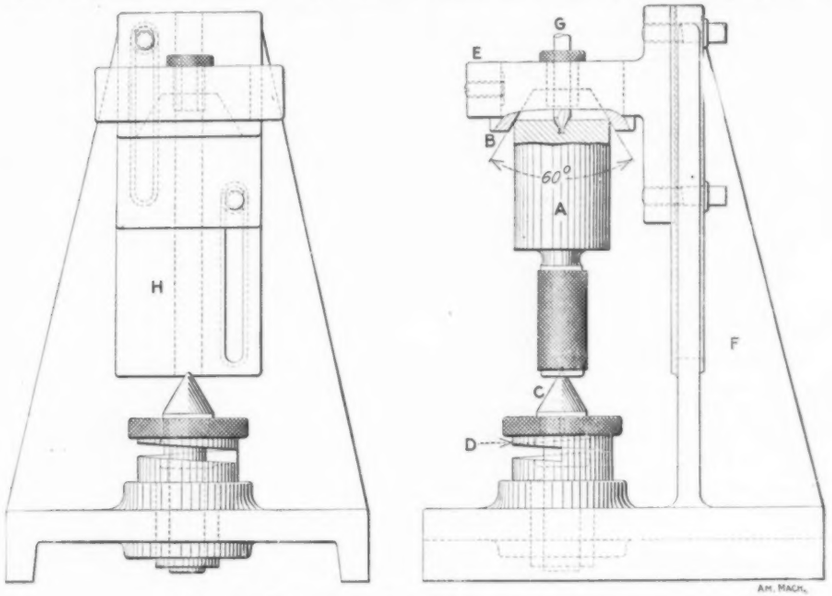


FIG. 2. PRODUCING GAGES ON THE AUTOMATIC

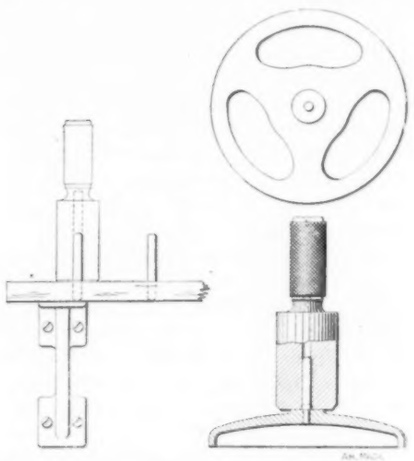
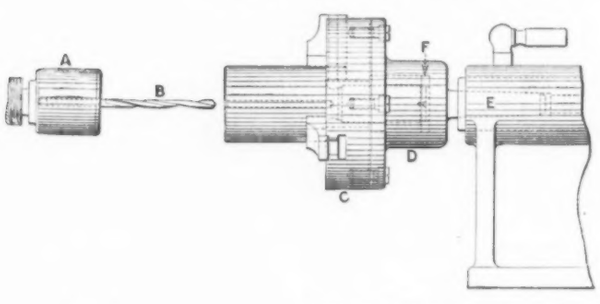


FIG. 5. SHELF FOR HOLDING GAGES

FIG. 6. STAND FOR HOLDING GAGES



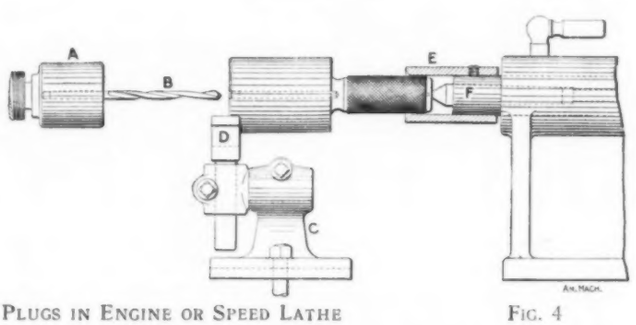


FIG. 3 METHOD OF DRILLING HOLES IN PLUGS IN ENGINE OR SPEED LATHE FIG. 4

PRODUCING GAGES ON THE AUTOMATIC

Gages are produced on the automatic screw machine, as shown in Fig. 2. The automatic produces these as shown, the knurled end being centered in the operation, using a high-speed drilling attachment for the purpose. By noting *A*, Fig. 1, it will be seen that the corners are broken at an angle of 60 degrees, as it is considered advisable in all cases not to have a sharp corner on the end of these gages. They are then taken to the driller. Fig. 2 shows an adjustable fixture for centering the large end. Here *A* is a blank gage, *B* a hardened bushing, *C* the center, *D* a cam-ring, *E* an adjustable arm carrying bushing *B*, *F* the frame and *G* the combination drill and countersink.

The form on cam-ring *D* for adjusting the center vertically has no machine work except boring the hole and turning and knurling the outside. The cam form is a rough casting. The same can be said of the sleeve on which piece *D* rests. In one turn of *D* the blank drops away about ⅜ in., enough to lift the blank off the center after the countersinking operation has taken place. This operation is performed very rapidly. The bushing *B* is the same angle as the corner of the blanks (60 deg.) and seats itself in the ground tapered portion of the bushing. When this drilling and countersinking operation takes place on the large end, the piece is practically true on centers.

For the five sizes of gages it is necessary to have five hardened and ground bushings *B* with the tapered portion against which the gages rest of different sizes and the taper long enough for the variation of each size gage. Arm E has a vertical adjustment for the different length of gages.

The centering fixture, Fig. 2, is used for drilling the small hole the length of the body in these gages, but not as satisfactorily as Figs. 3 and 4. In Fig. 2 the work is done in a vertical position and after the drill has reached considerable depth, it is difficult to remove the chips and the result is a possibility of breaking the drills. That is why the Cleveland company uses Fig. 3 for this purpose. The layout means an ordinary engine or speed lathe, or this same arrangement can be used on a small hand screw machine, either of these three machines being quite satisfactory for drilling this hole.

DRILLING THE HOLE

The chuck *C* is mounted on faceplate *D* and the stem *E* fits into the spindle on the lathe. A parallel instead of taper stem could be made when used in a hand machine. The ring *F* trues up and steadies the end of the gage when the drilling operation takes place. The plain end of the blank that fits in ring *F* would then always be within 0.002 in. in the forming operation on the automatic. When this end is taken care of and the jaws of the chuck are fairly true, a good outfit for the drilling operation is obtained. In drilling a small hole such a depth it is necessary to remove the drill several times so that the chips can be carried away, and at the same time take care of the lubrication. In a hole this depth it would perhaps be necessary to remove the drill half a dozen times.

Another scheme for the drilling of this small hole is shown in Fig. 4. Tests of this style of fixture show that it works

very satisfactorily. Base *C* is cast iron, planed at the bottom, and fits on top of the lathe bed. All the finish necessary on this piece would be the planing of the base and the boring of the hole. Piece *D* is V-shaped on top, in which the body of the gage moves longitudinally in the drilling operation. The three-piece swiveled affair can be moved in any direction very rapidly.

The piece *E* is fastened to the spindle, and the hole in it that envelopes the knurled end of the gage is about $\frac{1}{32}$ larger than the gage. This is done so that the gage when it enters piece *E* centers itself, and when it is moved back into position there is no danger whatever but that the countersink will be in line with the center *F*. By holding the knurled part in the hand, considering the diameter of drill *B*, it is not difficult to grip it tight enough for the drilling operation.

If the drill sticks in the hole to any extent in moving the blank back and forth on the V-piece *D* for the removal of chips and lubricating, and draws the blank with it, there is no danger of its falling away from the center *F* because it lies in the bushing *E*. This makes it a simple and safe fixture for this operation.

Carbonizing the Gages

The next operation is the hardening of the gage. These gages are carbonized and the depth of the hardening is about $\frac{1}{16}$ in. From tests made it was discovered that after hardening they are out of round about 0.002 in., and out of true from 0.008 to 0.012 in., so an allowance of about 0.015 in. for grinding was made. They are then taken to the lathe and the small end is countersunk and the center lapped out on the large end, to allow for anything that might occur in the hardening operation. They are then ground on the outside enough to remove the scale and allowed to season for a few days before grinding to exact size.

After a gage of this kind has been used for considerable time and is under size, it can be annealed and reduced to another size. As the gage is made from machine steel, there is no chance of cracking it in rehardening, as would be the case in the manufacture of tool-steel gages. It may be interesting to know the cost of these gages; the following are the figures:

COST OF PLUG GAGES FROM AUTOMATIC BLANKS

Size 2¾ in. Output 6 per hour in lots of 100 or more

Cost of one automatic blank, including material, based on lots of 100:		
Cold-rolled steel, weight 10¼ lb.	$0.245	
Average cost per blank of setting up machine	0.005	
Cost of automatic operation	0.01	Cost 1 blank 0.260
Cost of finishing gage on basis of 30c. per hour for all operations and in from half to one dozen lots:		

Tool Room Operations

1	Center, large end	4 min.	
2	Turn to size (allow for grinding)	7 min.	
3	Face front end	4 min.	
4	File and polish handle and front end	8 min.	
5	Drill hole in end and recenter	10 min.	
6	Drill hole in side	4 min.	
7	Mill flat on handle and stamp size	7 min.	
8	Carbonize ½ per lb.		$0.30
9	Harden ½ 5c., 6 lb.		
10	Polish after hardening	8 min.	
11	Grind outside diameter (allow for lapping)	16 min.	
12	Lap to size	40 min.	0.54
		108 min.	
	Total cost of 1 complete gage		$1.10

Size ¾ in. Output 38 per hour in lots of 100 or more

Cost of automatic blank, including material based on lots of 100:		
Cold-rolled steel, weight ½ lb.	0.0121	
Average cost per blank of setting up machine	0.005	
Cost of automatic operation	0.00158	Cost 1 blank $0.01868
Cost of finishing gage on basis of 30c. per hour for all operations and in from half to one dozen lots:		

Tool Room Operations

1	Center large end	2 min.	
2	Turn to size (allow for grinding	3 min.	
3	Face front end	2 min.	
4	File and polish handle and front end	5 min.	
5	Drill hole in end and recenter	6 min.	
6	Drill hole in side	3 min.	
7	Mill flat on handle and stamp size	7 min.	
8	Carbonize ½ per lb.		$0.250
9	Harden ½ 5c., ½ lb.		
10	Polish after hardening	5 min.	
11	Grind outside diameter (allowing for lapping)	10 min.	
12	Lap to size	25 min.	
		68 min.	$0.34
	Total cost of one complete gage		$0.36368
2-in. size, output 13 per hour, cost			$0.7587
1½-in. size, output 20 per hour, cost			0.57225
1-in. size, output 26 per hour, cost			0.461

It will be noticed that the cost of the different operations for only the smallest and largest gages is given; on intermediate sizes the total cost of gage is given.

A board with holes bored in it with a plain piece of wire pressed into this board on which to place the gages in the tool room is shown in Fig. 5. This is shown in shelf form and costs but very little. It can be made with one shelf above the other, or a long shelf if there is room. Gages mounted in this manner are entirely satisfactory.

The cost of the equipment for this gage manufacturing, the fixtures, the necessary mills, forming tools, cutoff and knurling tools, would be less than $300. This is estimated on the basis that you have no box mills, knurls, holders or any other tools to be used in connection with the manufacture of these gages. If you have, the cost would be somewhat less. The hardened shell $\frac{1}{16}$ in. thick is just as good as though hardened clear through. While gages that are lapped possibly look a little better, experience shows that they are exactly as good just as they come from the grinder.

A very cheap and serviceable stand for holding these gages is shown in Fig. 6. The machines in the Cleveland factory that produce the holes have a number of these stands, so that when a gage is obtained from the toolroom it is placed on a stand, and this is where the hole through the center of the gage works very nicely. The general run of gages used in factories, if there is no box or stand of some kind on which to place them, is likely to be used rather roughly in handling.

Metal Gage Adopted by S. A. E.

The Society of Automobile Engineers, at its annual meeting in New York during January, decided that gage numbers be omitted entirely and that the size be specified directly in thousandths of an inch. The sizes of the American wire gage rounded out to mils in the larger sizes and tenths of a mil in the smaller sizes are to be considered as standard. These sizes are as follows:

460	128	36.0	10.0
410	114	32.0	8.9
365	102	28.5	8.0
325	91	25.3	7.1
289	81	22.6	6.3
258	72	20.1	5.6
229	64	17.9	5.0
204	57	15.9	4.5
182	51	14.2	4.0
162	45	12.6	3.5
144	40	11.3	3.1

The above recommendation was made in view of the fact that these sizes are indispensable to the electrical industry and are practically standard with manufacturers of copper, brass, aluminum and other nonferrous materials in all shapes except seamless tubes.

A photographic campaign against coal-mine accidents, projected some time ago, has taken shape in an illustrated textbook just issued by the coal-mining department of the Delaware, Lackawanna & Western R.R., for the benefit of foreign mine workers who cannot speak English. It shows both the mistakes that cause accidents and the way to avoid these mistakes. Two hundred photographs are included in the volume, depicting on opposite pages the right and the wrong method of procedure in mining. In explanation of the pictures, text matter is given under them in the plainest of English; the "don'ts" on the accident side of the page being emphasized strongly by the use of red ink.

A Liquid Pressure Measuring Device

Special Correspondence

An apparatus specially designed to gage hydraulic pressures with more than usual accuracy. Friction reduced to a minimum, and a greater range of pressures obtained through spiral groove pistons and an ingenious arrangement of counterbalancing weights.

An occasion arose where it became necessary to have some means of accurately measuring liquid pressures up to about 750 lb. per sq.in., and with less accuracy up to 3000 lb. An accuracy greater than that of any hydraulic gage was required, and the apparatus shown in the accompanying illustrations was designed by A. H. Emery, of Stamford, Conn., and built under his supervision.

Experiments made in connection with close-fitting pistons proved that a straight piston or even one with a series of circular grooves, no matter how nicely fitted, gives a large amount of friction, which increases rapidly as the pressure rises. These experiments and the results were discussed in the AMERICAN MACHINIST, Vol. 30, Part 1, pages 795 and 796, and they proved that the friction is made very small and that it does not increase with the pressure if the pistons are provided with a spiral groove.

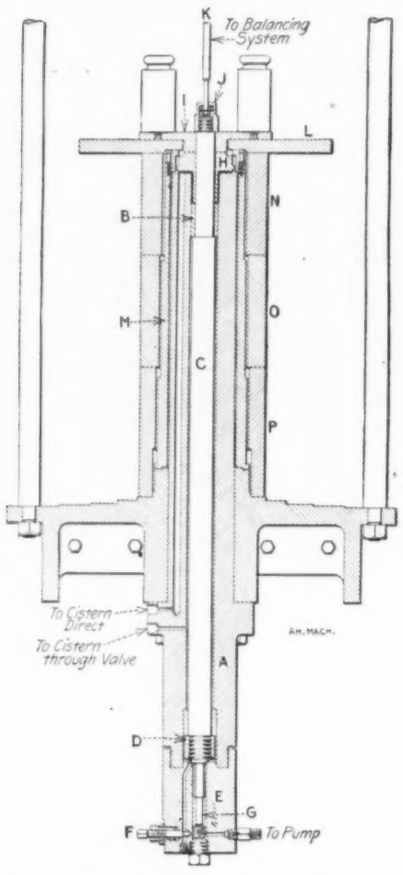


FIG. 1. SECTIONAL VIEW OF HYDRAULIC GAGE

THE APPARATUS IN DETAIL

The general idea of the instrument is a vertical cylinder, a piston rod running nearly through it and provided with a small piston at one end and a larger one at the other, passages and valves so arranged that liquid pressure may be admitted either to the small piston, or to both, the piston rod carrying a head, and weights so arranged that they can readily be placed on or picked up by this head. The two pistons give a much larger range of pressures, with a given amount of weights, than could be otherwise obtained. In order that the apparatus may be able to go to zero pressure, a "balancing" system is added to carry the weight of the piston, piston rod and head; and for convenience of use a screw pump is made an integral part of the mechanism.

A section of the cylinder, pistons, upper head, etc., is shown in Fig. 1, *A* being the main part of the cylinder, which has a hole bored through it and lapped near the upper end, in which the upper piston *B* fits very nicely; the diameter of the piston being 2.002 in. It was intended to be 2 in., but in getting the desired quality the hole was made oversize. This piston is a hollow cylinder, and fits on the piston rod *C*, which has near its lower end a collar *D*, which limits its motion.

On the lower end of the cylinder *A* is fastened a second cylinder *E*, with a 1.001-in. hole bored and lapped in it, this part was originally screwed onto *A*, but after testing the apparatus, it was found that the thread, although especial care was taken in manufacturing, caused the lower cylinder to have its axis slightly out of line with the axis of the upper, thus giving undue friction. The design was consequently changed and this cylinder fixed to the upper cylinder with six bolts. A pipe leading from the pump enters the side of this cylinder, and if valve *F* be closed, the pressure works only under the 1-in. plunger *G*, but if the valve *F* is open, it works under both plungers or on an area which is just four times that of the 1-in., as the diameters are exactly 2 to 1.

The cylinder *A* has a ledge on its upper end, and a vertical hole inside this ledge leads to a pipe connecting with a cistern constructed with an overflow pipe and so placed that the surface of the oil in it is just above the upper face of *A*. A second pipe, containing a valve (not shown) connects the space between the 1-in. and 2-in. pistons with the same cistern. When using the 1-in. plunger, the valve *F* is closed and the valve in the pipe to the cistern open, these conditions being reversed when using the 2-in. diameter.

On the rod above the 2-in. piston is a head *H*, and above this a second head *I*, fastened to the rod by nut *J*, which contains in its upper end a ball bearing for the very easy rotation of these parts while suspended from the balancing system by rod *K*. Application of pressure from the pump under the piston causes the piston rod to move up, and a $\frac{1}{16}$-in. movement of the piston causes the head *H* to pick up weight *L*, which weighs approximately 78½ lb., and corresponds to 25 lb. on the large plunger, or 100 lb. per sq.in. on the small plunger. A further piston movement of $\frac{1}{16}$ in. picks up the weight *M*, which successively picks up the three weights, *N*, *O*, *P*, each of them being equivalent to 25 lb. per sq.in. on the 2-in. piston.

Weights can be placed on the head *I* to balance, and so measure the pressure under the piston. There are 8 weights (2 only are shown) of approximately 7⅞

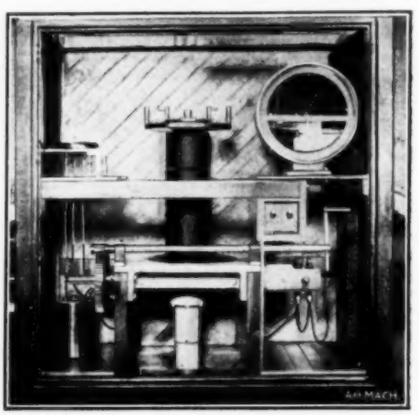


FIG. 2. APPARATUS IN ITS COVER

lb., corresponding to 2½ lb. per sq.in. each on the 2-in. diameter or 10 lb. per sq.in. each, if on the 1-in. diameter and 4 for 1 lb. per sq.in. on the larger area, or 4 lb. on the smaller, a slide weight on the balancing system giving one pound per sq.in. for the 2-in. diameter, when slid the length of its rod. The rod being graduated, any desired fraction of a pound can be obtained.

This gives us a range of pressure from zero to 150 lb. per sq.in. on the larger area. Higher pressures are obtained by the use of three concentric weights, weighing, respectively, 314, 628, 942 lb., which are fastened to the weight *L*, either separately or together. All together give us a total range from zero to 750 lb. per

sq.in. on the large, or from zero to 3000 lb. on the small.

The machine, Fig. 2, is seen in its case with these three outer weights, and the balancing system removed, with the piston rod forced out of the cylinder lifting the large flat weight *L*, and the inner

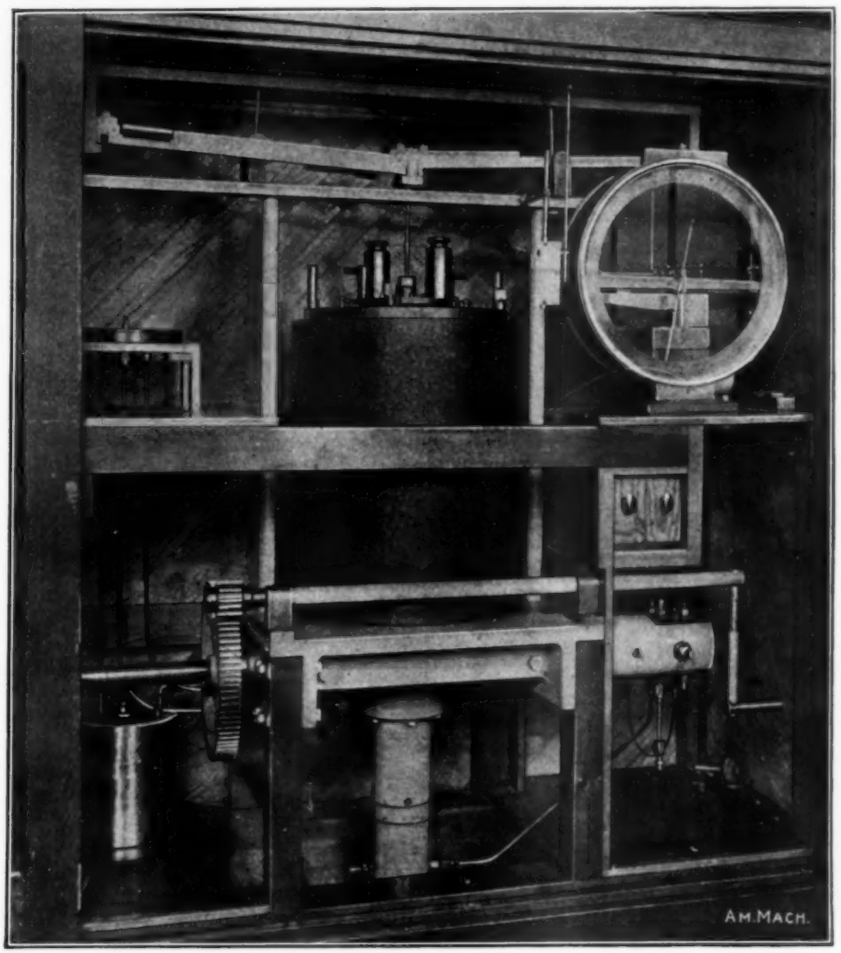


FIG. 3. THE COMPLETE APPARATUS

weight *J* lifting the three 78½-lb. weights referred to. The cistern is seen at the left with a tank under it, which contains a supply of oil for the pump. One end of the pump barrel is seen at the right with its valves and connecting pipes. The pump screw projects at the other side through the large gear, which drives the screw by a couple of splines sliding in spline-ways in the screw, the screw running in a bronze nut in the end of the pump barrel.

The apparatus complete is shown in Fig. 3. The large weights and the balancing system, the plate *L* bolted to the largest weights, and two weights on the platform *I* are all shown. The 1-lb. slide weight and the indicator for showing the number of weights in use are readily seen.

The balancing system consists of a couple of uprights carrying a crosspiece, on which are placed a couple of U-shaped castings carrying ball bearings for the axles of two levers of equal arms. On each end of each of these levers is an arc, and between the inner ends of the two is a flat piece, into which is screwed the rod connecting to the ball bearing at the upper end of the piston rod. This flat piece is fastened to the lever by two sheet-brass belts, one end of the belt being fastened to the lower end of the flat piece and the other end to the upper part of the arc. At the outer end of the levers similar belts connect with vertical bars projecting from a crossbar, the weight of which serves to balance the weight of the piston rod, etc.

The cylinder, up to the overflow pipe just inside the ledge referred to, is at all times full of oil, which floats a portion of the weight of the piston and rod, and as the piston moves up in picking up the weights, less of it is submerged. To take care of this changing amount of displacement, a couple of vertical rods, fastened to the two levers, carry weights on their upper ends, and by their changing leverage counterbalance the change, the weights and their arms being proportioned therefor.

In balancing this apparatus the pump is disconnected, and the valve *F* and the valve in the pipe to the cistern are opened and the whole thus made subject to a cistern head only, and when so open a change of 0.01 lb. per sq.in. can be readily observed. As the friction of the piston does not increase at all as the pressure runs up, it is probable that the error in use is as small at this for all loads for the large area, or 0.04 lb. per sq.in. for pressures measured on the small piston.

The pistons and weights are rotated when the apparatus is used, as this very greatly reduces the small amount of friction between the pistons and the cylinder. If the apparatus is being used to give hydraulic pressure it insures giving the exact amount; if it is being balanced or used to measure pressure, or if the load placed on the piston is too small, the piston will move upward, and this will be seen on the indicator mentioned. This indicator also shows when the weights *L*, *M*, *O* and *P* are picked up.

Whitworth Thread for Stay-bolts

While we are eliminating the V-thread, and doing all in our power to further the use of the United States standard, or Franklin Institute thread, or more properly still the Sellers thread, we have not appreciated the fact that the Whitworth thread was being used to any extent in this country.

Inquiry among locomotive builders, however, develops the fact that in nearly all cases, stay-bolts for locomotive boilers are being made with the Whitworth thread. This form has been adopted by both the American Locomotive Co. and the Baldwin Locomotive Works, these two concerns building practically all the locomotives constructed in the United States.

This came about from two reasons. Specifications for locomotives for foreign countries always mentioned Whitworth threads. Then too, boiler-shop men fell into the habit of making their taps and dies with rounded points, so that they were practically getting Whitworth conditions. Even with the United States standard thread the stay-bolt tap is very apt to become rounded on the top, as boiler sheets are often quite hard.

In view of these two conditions, and the undoubted fact that the Whitworth thread makes a stronger bolt for both tension and vibratory strain, this thread has been adopted on stay-bolt work. It is more expensive to make and to maintain the tools for it, and is not to be recommended for general work. Stay-bolt strength, however, is vital to any boiler, the question of safety being paramount to all others. Only one pitch is used, all staybolts having 12 threads per inch.

Uses and Advantages of the Latch Jig

By J. N. Bethel*

Simplicity, accuracy, durability, rapidity, cleanliness and accessibility are the characteristics recommending this type of jig to the designer and user.

Facilities for making such jigs in quantities from stock parts form one of the important features of a large manufacturing plant.

*Superintendent, Taft-Peirce Manufacturing Co., Woonsocket, R. I.

Of all the special tools used in a modern manufacturing establishment for the economical production of a large number of small parts, no tool offers in its scope, a wider adaptability for the rapid production of interchangeable parts than the latch jig. In fact, no tool offers a more satisfactory subject to the tool designer than this particular type of tool.

The evolution and refinement of the latch jig has been accomplished through urgent demands for a jig that must be simple in construction; capable of producing uniformly accurate work; designed to withstand rough usage; rapid and easy of manipulation; easily cleaned, and accessible whne clamping and removing the work.

All of these essentials are embodied in this particular type of tool. One movement is sufficient to open it and expose its gage points and nest. It is easily and quickly cleaned. It is conveniently and quickly loaded. It is simple in its construction, hence capable of withstanding rough usage and still maintain its accuracy. One movement and the cover is closed and the work clamped securely in position. Speed, the most desirable feature of a good tool, makes the quick-acting latch jig a most desirable factor in good tool design.

Referring to Fig. 1, the component parts of this tool may be enumerated as follows: *A*, Frame; *B*, cover; *C*, cover hinge pin; *D*, latch; *E*, latch hinge pin; *F*, latch fulcrum pin; *G*, latch stop screw; *H*, latch stop-screw nut.

It is not feasible to use a latch jig on work that varies greatly in thickness, such as rough castings and rough forgings, without providing a compensating device on the cover. This is due to the fact that the cam on the latch is short, and provides approximately 0.03 for variation in the thickness of the work.

Generally speaking, there are three styles of this type of jig, and they may be designated as follows: The open type, the box type and the reverse type. The open type, with handle and latch projecting as illustrated in Fig. 2, is particularly recommended for flat work, which requires plenty of finger room. The gage points and nest are conveniently located. This type is recommended where holes are to be drilled and reamed at right angles with the side of the work only.

When the parts to be drilled are of uniform thickness, if so desired, the bushings may be located in the cover. It is good practice to do this whenever possible, as it dispenses with the necessity of turning the jig over when preparing for the actual operation of drilling.

If the work varies considerably in thickness, the cover may be clamped on a finished seat at *A*, Fig. 1, and a binding screw added to the cover for clamping the work. By this method the center line of the bushing will be presented at right angles with the nest or gage seat, which receives the work.

In addition to the open type, an illustration is given in Fig. 3 of the inclosed or box type, which permits the use of bushings in the sides as well as in the cover and bottom. This jig is capable of accommodating a diversified line of parts with very satisfactory results.

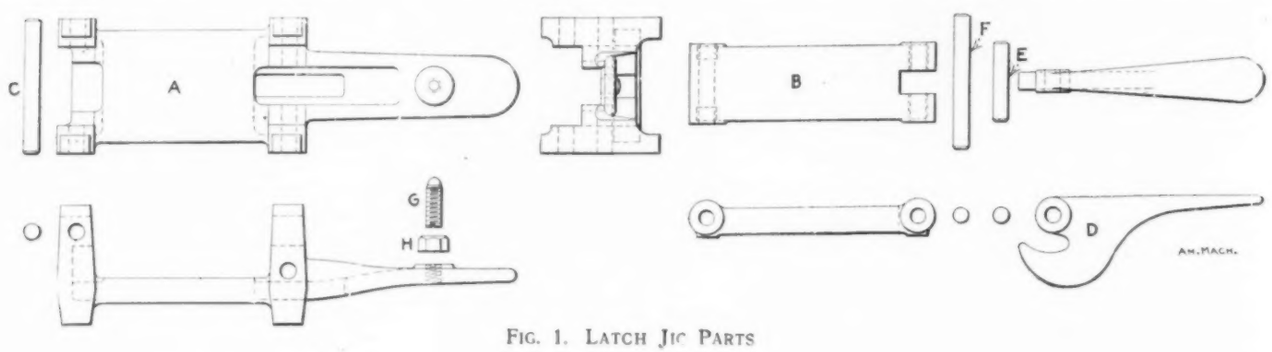


FIG. 1. LATCH JIG PARTS

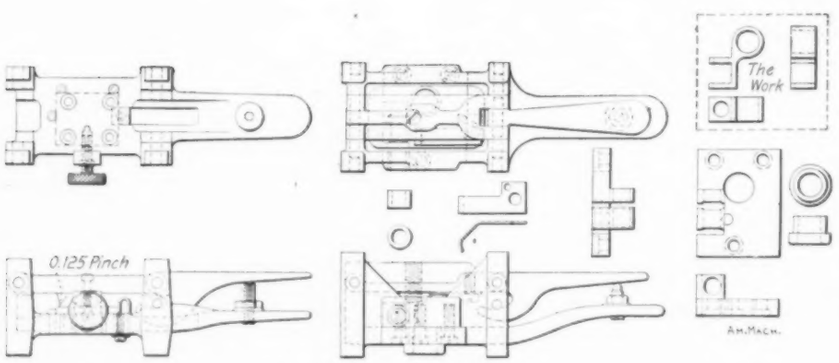


FIG. 2 TWO TYPES OF LATCH JIGS

FIG. 3

Frequently it is necessary to drill a part from five sides. To do this, a very ingenious arrangement is used, as in Fig. 4, whereby the handle is dispensed with and the latch is reversed to swing toward the center of the jig, using an offset cover to accomplish this purpose. This jig is capable of a very wide range of work and gives excellent results.

In the Taft-Pierce Manufacturing Co.'s very elaborate and complete stock of standard jig, fixture, punch and die and miscellaneous tool fittings, there are kept eight sizes of jig frames and fittings in steel castings. These are being constantly used and adapted to the needs of the rapid and accurate production of parts for adding machines, typewriters, sewing machines, cash registers, parts for small automatic machinery, motorcycle motors, automobile parts, etc. These stock-jig parts are represented in Figs. 5 and 6, and a group of completed jigs is seen in Fig. 7.

Where large quantities of work are involved, it is good practice to make the

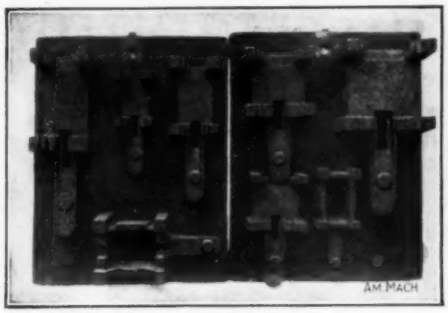


FIG 5 STANDARD JIG PARTS

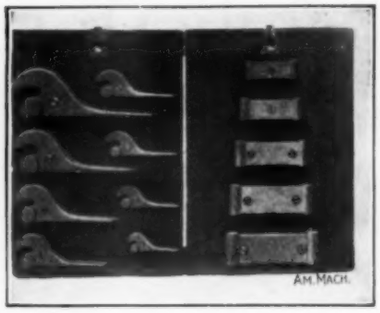


FIG. 6

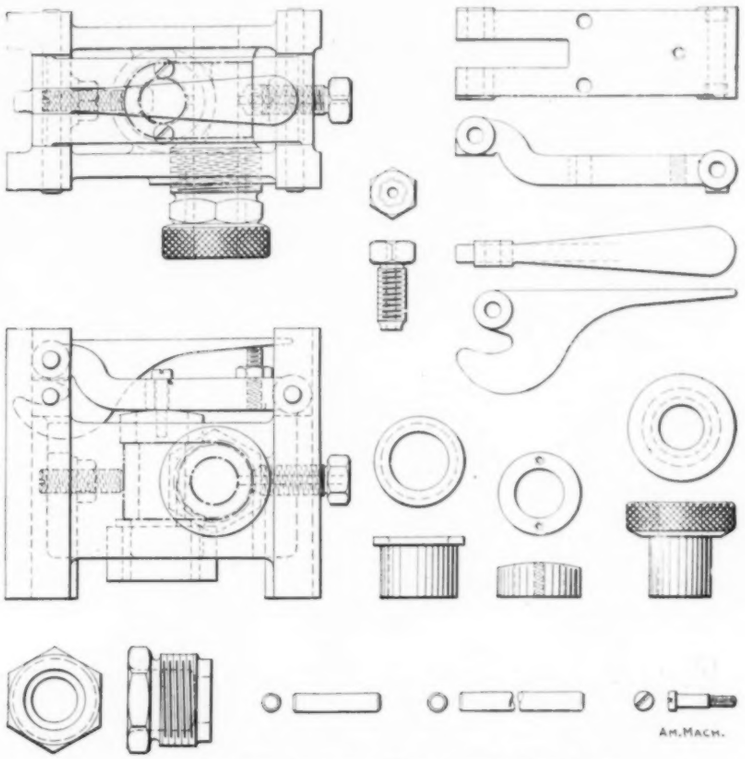


FIG. 4. JIG FOR DRILLING WORK FROM FIVE SIDES

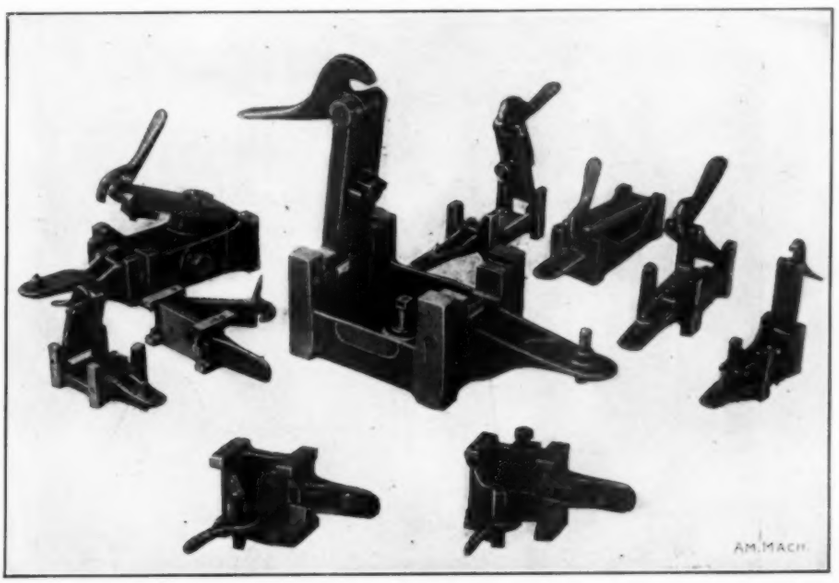


FIG. 7. A GROUP OF LATCH JIGS

frame of a steel casting and harden the feet. This is best accomplished by machining the body of the jig before boring to receive the drill bushings. Drill the holes to receive No. 4 cover hinge pin and No. 6 latch fulcrum pin, then pack the frame in an iron box and cover the work with any of the carbonizing preparations. Seal the box to make it air tight and heat the work in a hardening furnace to about 1500 to 1600 deg. F. for a period of six to eight hours, depending upon the size of the frame. Remove the box from the furnace, keep it sealed to exclude the air, and allow the work to cool in the box.

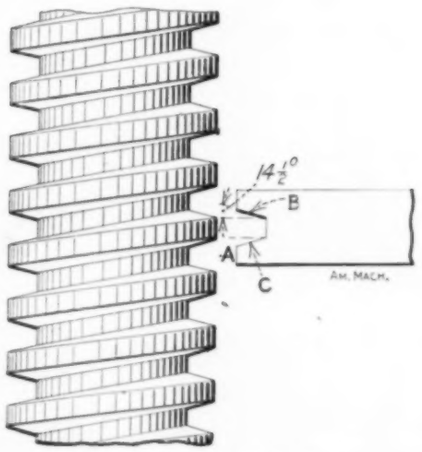
Next, heat the ends of the feet for a distance of about ¾ in. in the lead pot to a cherry red and quench in cold water. Surface grind the legs, the feet and the seats square with each other, then bore for the drill bushings, registering from the hardened and ground surfaces. By pursuing this method, an accurate and extremely durable jig is obtained.

Cutting Acme Threads

BY B. H. PURCELL

The following is a description of a tool I use in cutting Acme threads:

Instead of feeding straight in with a roughing tool and then finishing, I feed in at an angle with the tool shown in the sketch. The cutting edge *A* cuts the bottom of the thread; the edge *B* cuts one side; and while feeding in at an angle of 14½ deg. the edge *B* forms



CUTTING ACME THREADS

the other side of the thread. For the finishing cut the tool is fed straight in, cutting at *A*, *B* and *C*. Very heavy cuts can be taken with this tool as the chips come out free and do not wedge in the threads.

I use this tool for cutting special jackscrews of cold-rolled steel with the threaded part 2¼ in. in diameter, 18 in. long, 2 threads per inch, cutting them on a 14-in. patent head lathe in 10 minutes each. About 8 minutes actual cutting time produces a smooth thread.

Building a Brick-Making Machine

By C. A. Rogers*
and Loyd Smith

Ordinarily a brick machine is not considered very high-grade, as far as accuracy is concerned. An exception, with a capacity of 40,000 bricks per day; some of the operations in making it.

*Superintendent, Enamel Concrete Co., Des Moines, Iowa.

The waterproof, enamel-face brick, Fig. 1, is made under great pressure on the machine shown in Fig. 2. The bricks are absolutely of one size, with a beautiful face of any color, and clean square edges and corners. The following is a brief description of the operation of the machine:

A set of 30 mold boxes is mounted on as many carriers, more clearly shown at *A*, Fig. 3, which in turn are bolted to the links of an accurately made chain passing over sprockets at each end of the machine. These sprockets are rotated intermittently at the proper time by the pulling device and ratchet shown in Fig. 4.

When the box is in the position shown in Fig. 2, the pallet upon which all of the bricks are made—a pile of pallets is shown in the foreground in Fig. 2, and one in detail at *C*, Fig. 5—is placed in position in the bottom of the box where it is firmly held until automatically released at the other end of the machine. When the box passes under the facing tank *D*, Fig. 2, it receives the facing material which is automatically dipped up by a set of cups, not shown, but fastened to the arms *E*; at the proper time these cups are dumped into the box first to form the enamel face of the brick.

The box is then moved under the tank or agitator *F*, Fig. 2, where it receives the body material of the brick. From here

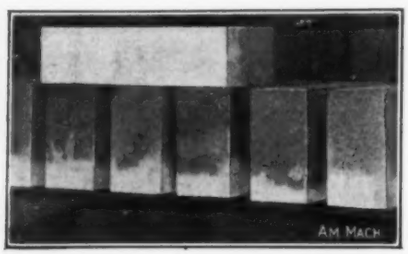


FIG. 1. THE BRICK

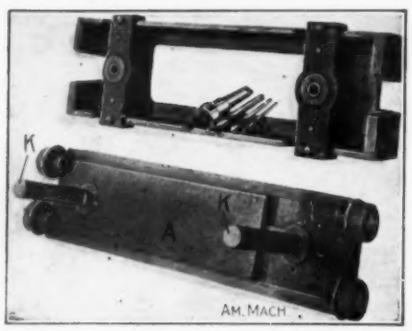


FIG. 3. THE MOLD BOX

it is moved along under the pressure tamp, not shown, where a great pressure is brought upon the brick by means of a pair of very strong toggles. The next and last step is under the releasing tamp, which comes down and rests very gently upon the brick, while the box is lifted off automatically by a pair of lifters, operated by a set of cams (not visible). The pallet with the brick is then lifted off of the machine and placed upon a car. The machine is full automatic, has a capacity of 40,000 bricks per day, and weighs 67,000 pounds.

In this machine there are 30 sets of mold boxes with compartments for eight bricks for each box; the boxes must pass and pause under two tamps that fit the boxes rather closely and at the proper time; also there are 10,000 pallets for each machine, the machines are scattered over a large territory, and boxes and pallets must fit all machines. It is plain, therefore, that accurate work is required in producing them.

THE FEED RATCHET AND PULLING DEVICE

The feed ratchet and pulling device are shown enlarged in Fig. 4. The cam arm *G* is pulled forward at every alternate revolution of the machine and coming in contact with roller *H* lifts the dog *I* out of engagement with the ratchet, which causes a pause of the boxes long enough for the various operations to be performed. Fig. 6 shows the other end of a machine under erection, and a number of carriers *A* in position, as well as

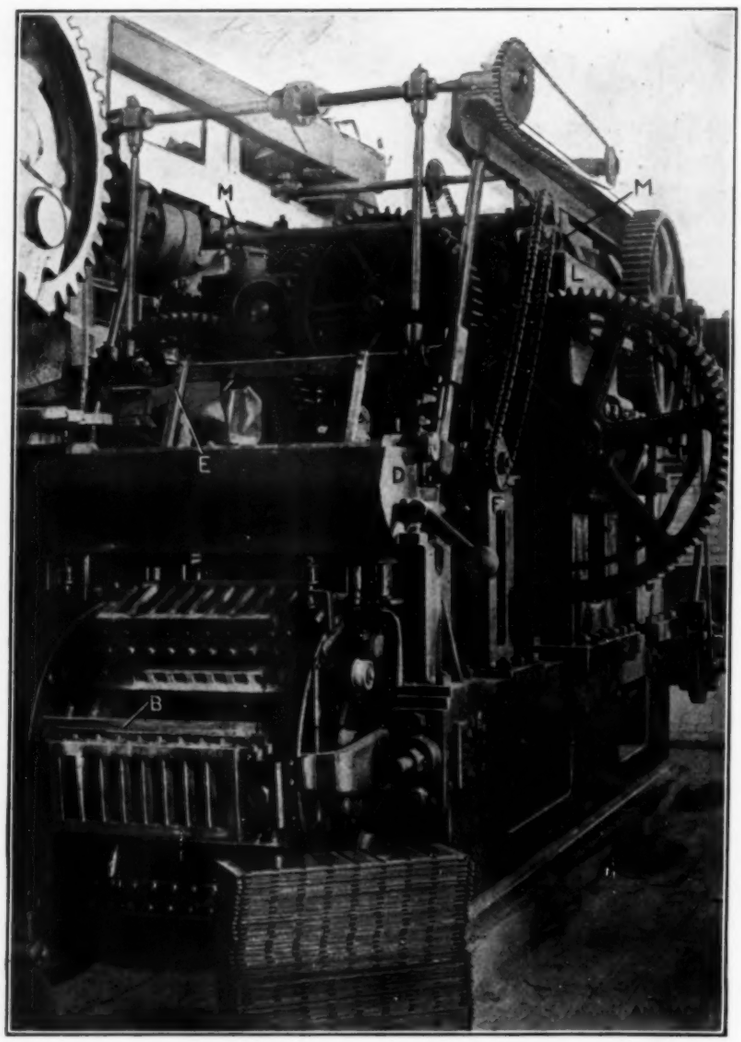


FIG. 2. THE NEW BRICK MACHINE

a section of the chain *J* with a carrier removed.

The Carrier

In Fig. 3 is shown a carrier complete, with the jig for drilling all of the holes, and the drills and reamer for the taper-pin holes. The holes for the pins *K* have taper seats, the remainder of the holes being tapered. The pins are screwed in and the flat spots are laid off for a milling. These pins are the only parts not interchangeable; as they are screwed in it will be readily understood that the flat spots must be laid off. The purpose of these spots is to prevent the pins from turning by means of keepers fastened to boxes. The keeper coming in contact with the outward end of the spot, prevents the box from dropping off the pins while passing back under the machine.

Fig. 4. The Feed Ratchet

There are four rollers, two at each end of the carrier, which moves along on rails provided for this purpose; but they receive no pressure other than the weight of the box carrier and brick, because while the box is under the pressure tank and the brick is being pressed, the bottom of the carrier rests upon a pressure plate.

The top pressure plate *L*, Fig. 2, and the nuts in which screw four 5-in. bolts, passing down through the bottom plate, will give some idea of the construction.

Fig. 5 shows the assembled box *B*, bottom in view. The jig, Fig. 5, is for locating the pin holes *O* in the box. There is a projection *P* at each end, just the size of a brick, that slips into the two end compartments of the box. Bushings are put in and the holes drilled first in the solid; another set of bushings is slipped in the jig and a three-fluted drill enlarges the holes to reaming size; then reaming bushings are put in—these just fit the hardened shank of the reamer. The holes are now very carefully reamed to a size that will allow the box to slip up and down on the pins.

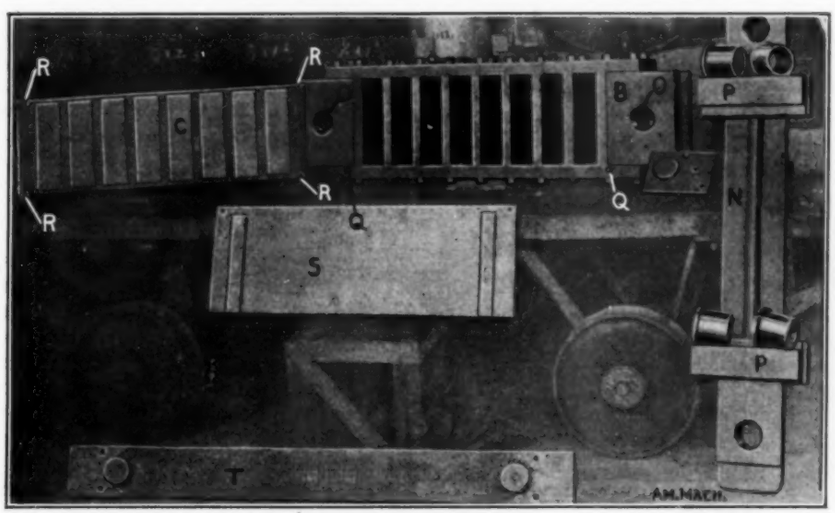


Fig. 5. The Assembled Box

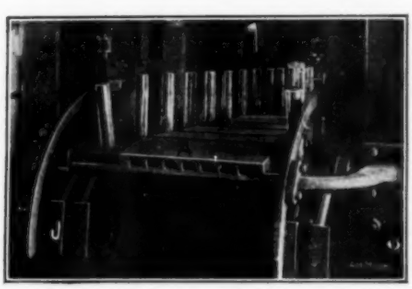


Fig. 6. A Machine Under Erection

It will be noticed that there are two small dowel pins *Q*, Fig. 5, in the bottom edge of the box and that there are two small notches *R* on each side of the pallet *C* that fit down on the dowel pins *Q* when the pallet is in place. These dowel pins and notches are to make it easy to slip the pallet quickly into place.

The pallet is milled both lengthwise and crosswise, so that it will fit the box very closely. The jig *S* is to locate these dowel pins. The jig *T* is for locating the dogscrew holes shown near the large pin holes.

One of the box sides *U* with some of the tools for producing it is seen in Fig. 7. The material is mild steel finished all over by milling; only one cut $\frac{1}{16}$ in. deep on all sides is taken. The cutters are inserted teeth, except the cross-cutters

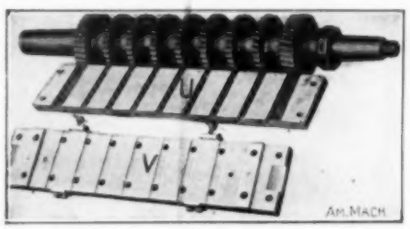


Fig. 7. One of the Box Sides

shown in Fig. 7. With a peripheral speed of 70 ft. per min. and a feed of 4 in. per min., a very good finish is obtained and a variation of thickness of 0.001 inch.

After this, the box sides are set across the machine and the set of gang cutters shown in Fig. 7 is used to mill the slots for the box heads and partitions. These cutters are the very best and are accurately spaced. One set is intended to mill a good many plates without grinding, as it is very necessary to keep the cutters in space to very close limits.

The jig *V* is then used to locate the bolt holes. The partitions are of the same material as the sides and are finished in the same manner. The ends are faced with gang cutters, so that they will be square and of equal length. The box heads are planed in a string jig, which holds 16 at one setting, and so

Fig. 8. The Polishing Wheels

clamped that the heads can operate on all 16 at once.

The box is then assembled with clamps to hold it together, while the holes in the heads and partitions are drilled and tapped by first starting a drill the size of the holes in the sides and then changing to a drill of suitable size for tapping.

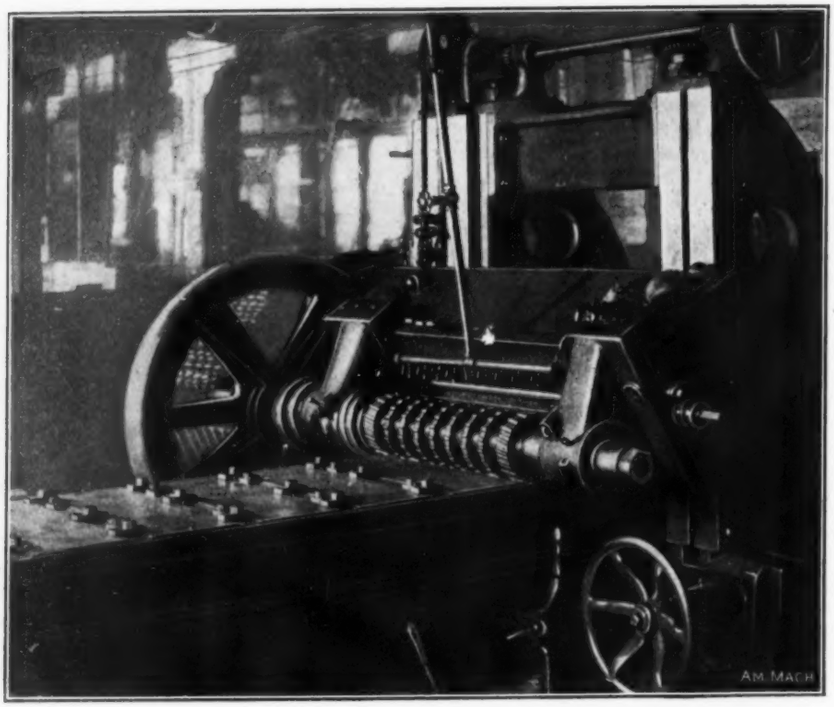


FIG. 9. THE MILLING OPERATION

THE PALLET

The pallet *C*, Fig. 5, in itself is an interesting piece of work. There are 10,000 to each machine. They are made of universal tank-plate stock, 12-point carbon steel, ¼ in. thick, 9 in. wide and 26½ in. long. They are first placed on the slab mill lengthwise in three rows and are milled with a set of gang cutters ⅛ in. deep, so that they will just fit in the box sidewise. They are then placed on the slab mill crosswise and milled to fit the box lengthwise, as shown in Fig. 9.

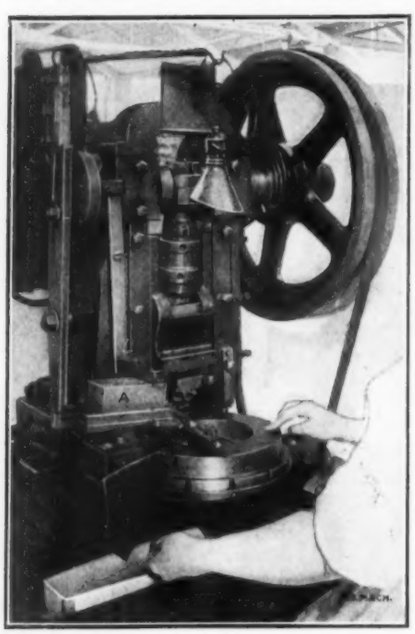


FIG. 10. NOTCHING THE PALLET

The cutters are of the inserted type, with blades of special high-speed steel. The peripheral speed is 70 ft. per min., with a feed of 8 in. per min. When the machine is run to its full capacity of 40 pallets per hour, two men are required, this being necessary because of the large number of clamps required to hold the work firmly in place under the nine heavy cuts and the difficulty in getting to the back end of the machine to take them off.

The machines are flooded with cutting compound and are all set on a cement floor surrounded by a slight elevation of cement. They are drained to a cistern from which the compound is pumped to a tank on an upper floor, from whence it runs by gravity to the various machines.

THE CUTTER PROBLEM

It might not be out of place to state here something about experiences with cutters, as both solid and inserted cutters have been tried on the job. On account of its length, the arbor has to be of rather large diameter, $3\frac{3}{16}$ in. As the cutters are 7 in. in diameter, solid cutters of special high-speed steel would be very expensive. Solid cutters having, of course, more cutting edges than the inserted one, a faster feed can be maintained, but when a tooth or a cutter breaks, it means a severe loss, and when replaced with a new one it would often have to be ground down considerably to suit the others of the set.

With the inserted cutter a new blade or set of blades can easily be put in, although there is quite a loss in these, as they have to be set deep in the body to keep them in place, and after repeated grinding have to be discarded, except the few that can be used for small tools. After a fair trial, the inserted-tooth cutter has been adopted as the most economical.

POLISHING AND NOTCHING THE PALLETS

The pallets, after milling, are taken to the paintroom and painted on the back and in the groove made by milling. They are then taken to the polishing wheels shown in Fig. 8, where the faces, upon which the brick is made, are polished. They were at first held in the hands, but the machine shown in the cut was devised for holding them.

It will be noticed that there are two sets of springs, one near the floor at *W*, that holds the plate *X*, which supports the pallet in place, and another at *T*, holding the machine away from the wheel. The pallet is shown in place in a clamp *Z*, which is moved along the platen lengthwise by means of a rack and pinion worked by the handwheel. The operator holds onto the handwheel only, and, by turning it in either direction, brings the different faces under the wheel; by pushing in, or up and down, he gets any pressure desired. The work is easy and a much nicer job is done in much less time.

The pallets are now taken to the punch press, where the notching is done; this is a very particular operation, as they must be absolutely interchangeable. They are slipped into a jig that gages them from the center slot, as shown in Fig. 10, the press not being large enough to punch all four notches at once; also they are gaged sidewise against the milled edge of the end faces.

The brick machine is built by the Enamel Concrete Co., Des Moines, Iowa.

The Franklin Institute, acting through its committee on Science and the Arts, recently awarded the Elliott Cresson gold medal, the highest in the gift of the Institute, to the following gentlemen: Alexander Graham Bell, Washington, D. C.; Samuel Wesley Stratton, Washington, D. C.; Albert A. Michelson, Chicago, Ill.; Alfred Noble, New York City; Elihu Thomson, Swampscott, Mass.; Edward Williams Morley, West Hartford, Conn.; Johann Friedrich Adolph von Baeyer, Munich, Germany; Sir William Crookes, London, England; Sir Henry Enfield Roscoe, London, England.

Laying Out Silent Chains*

By Chester S. Ricker

Some of the general requirements demanded by the various makers and suggestions that may prove helpful in designing.

*Excerpt from a paper read before the Society of Automobile Engineers.

Of necessity I must be brief in the consideration of the layout and design of the drive. The makers of the chain have engineering departments that do nothing but this work and being specialists they can do the work much more quickly and better. However, for the engineer who is laying out a new motor or transmission, it is valuable to know approximately what is required, so that he can modify the rest of the design to better apply the chain. I am, therefore, going to give some of the general requirements demanded by the various makers and also add some notes and suggestions which may prove helpful when designing.

Points to Be Considered in a Drive

1. Speed of chain.
2. Ratio between wheels.
3. Position of drive.
4. Efficiency of lubrication.
5. Distance of centers.
6. Proportions of the chain and wheel teeth.
7. Continuous or fluctuating load.
8. Size of chain relative to power transmitted.
9. Design of bearings.

Speed

About 1300 ft. per minute is the normal maximum. When provided with an oil bath, silent chains may be run up to 1800 ft. per minute in the small sizes.

Ratio between Wheels

For most chain drives which we will consider, the ratio is fixed at 2: 1, the only exceptions being in some of the auxiliary drives and on transmissions. According to Renold the maximum normal gear ratio desirable is 1: 6, although 1: 7½ can be made to work. From this it is evident that the gear-ratio problem has no terrors for the automobile designer. Under ratios of wheels might be mentioned the number of teeth, both maximum and minimum, permissible. According to Renold, never less than 15 teeth on the pinion, and if possible 17 or more should be used. Note that an odd number must be used to give a hunting-tooth effect and thus increase the life of the wheel and chain. Coventry chains are run over 15-tooth pinions, but it is deemed bad practice. The Maximum silent chain has been designed to run over 17-tooth minimum sprockets. For camshaft drives they recommend that 21 and 42 teeth, respectively, should be used.

Position of the Drive

According to the Coventry chain, it is advisable to keep the drive as nearly horizontal as is considered consistent with the surrounding design. When inclined, the line joining the centers of the wheels should never be more than 60 deg. from the horizontal. *The line joining the centers of the wheels should never be vertical.*

Efficiency of Lubrication

It is to be remembered that the life of the silent chain under automobile conditions is largely dependent upon the wear at the joints. On account of the high speed and the whipping of the chain it is important that the joints be well oiled. Hence, it is important that plentiful lubrication be supplied. Where splash lubrication is employed I would suggest that the supply pipe be so placed that it would direct the fresh oil on to the inside of the chain. Centrifugal force will then work it through the chain more efficaciously.

Factor of Safety

This is the proportion which the breaking load of the chain bears to the driving pull. The factors may vary from 30 for 1.75-in. pitch chains to 50 for 0.5-in. pitch chains at the maximum speed. These factors are not needed to insure safety but to obtain a reasonable bearing pressure on the studs. Mr. Hill, of the Coventry Chain Co., states that the life of a silent chain depends on the amount of pressure per square inch of projected rivet area, and the hardness of the wearing surfaces. It is found in practice that not more than 650-lb. pressure to the square inch of such projected area should be allowed. This, however, does not take into consideration the lubrication of the drive or the lack of adjustability or impulsive drive such as found on a camshaft. Hence, the reason large factors of safety are absolutely necessary at the present time.

Center Distances

According to Renold, the minimum distance between the shafts is equal to 50 pitches of the chain used. The distance may, however, be reduced until the wheels only just clear, but the life of the chain decreases out of all proportion to the decrease in center distance.

According to Mr. Hill when the ratio of the drive is less than 3: 1, the centers should be at a distance L.

$$\text{Center distance } L = \frac{D + d + p}{2}$$

Where

D = Pitch diameter of large wheel.
d = Pitch diameter of small wheel.
p = Length of pitch inches.

Naturally, this applies only to two-wheel drives. Where other drives are used it is essential to get them as short as possible. This is contrary to the advice of Renold. However, the data of the latter apply to the general application of chains. For camshafts the Coventry rule is, I think, approved by Renold.

Some adjustment should, if possible, be provided. If a jockey wheel is used to accomplish this, where adjustable centers cannot be had, it must mesh with at least three teeth in the chain. This is because a silent chain will not run like a rack. No pulley must be put on the back of a chain. The only time when this is allowable is when it is used to prevent whipping. If it is placed where it clears the chain under normal running conditions, and only touches it when the latter begins to slap, a leather pad may be used. At the most it seems like a makeshift.

The Wheels for the Chains

To repeat, the minimum number of teeth in wheels is 17. At the other extreme 90 teeth is the maximum consistent with good running. The wheels are all cut with a rotary cutter, but the process has to be done very carefully. Most of the chain manufacturers insist on cutting the wheels themselves. However, for those who are interested I have appended some data on wheel-tooth design.

For material Renold uses pinions made from mild-steel bars case-hardened. The large sprockets are usually made of strong hematite iron, while for those of very light or special design steel or phosphor-bronze castings are used.

Several methods of adjusting the sprocket with reference to the shaft to which it is fastened are shown. The purpose of this is to not only have an easy means of correcting for lag or lead in a chain, but for initial setting of the valves due to coarseness of adjustment with chains. The methods of holding chains upon the wheels differ with the type of chain used.

Renold.	Grooved wheel.	Flanged wheel.
Coventry.	Grooved wheel.	Guide plates.
Morse.	Grooved wheel.	
Whitney.		Flanged chain.
Maximum.		Guide plates.

Number of Links

When a chain is designed to run over a set of pulleys, having a fixed center distance, it should be so proportioned that there will be an even number of links. This will permit the chain to match up perfectly. If an odd number of links or pitches is used a "cranked link" will have to be used. This not only makes a poor job but materially weakens the chain. Hence, always design a chain to have an even number of links.

Some Chain Sizes Recommended

The Renold Chain Co., in its bulletin on camshaft drives, January, 1911, gives some data on the size of chain to be used.

For engines 1 to 6 cylinders, bore 70 mm. or less. For single camshaft, 0.5-in. pitch, 1.2 in. wide. For double camshaft, 0.5-in. pitch, 0.9 in. wide.

For engines 1 to 6 cylinders, bore 71 to 100 mm. For single camshaft, 0.5-in. pitch, 1.4 in. wide. For double camshaft, 0.5-in. pitch, 1.2 wide.

For magneto only. On engines 1 to 6 cylinders, bore 100 mm. or less. 0.5-in. pitch, 0.65 in. wide.

For the chains 1.2 and 1.4 in. wide, mentioned in the above table, it is quite satisfactory to use the center guide plate, and it is strongly recommended that the outside guide-plate type be used for the 0.9 and 0.65 in. wide sizes. All these widths may seem great for the work to be done, but the allowable wear is, comparatively speaking, so small that the low bearing pressures are necessary.

Design of Bearings

It will be noted that on almost all the drives, where possible, there are bearings on either side of the chain wheels. This is a wise precaution, because the weight of the chains is considerable, and unless large bearings are used, it may tend to disalign the shafts.

Cone Pulley and Back Gear Chart

By H. F. Moore

Responding to the invitation in Mr. Halsey's article on Cone Pulleys and Back Gears, page 211, I submit the accompanying chart which does even more than he had in mind.

To use the chart it is only necessary to divide the largest by the smallest r.p.m. of the machine spindle and find the resulting quotient in the base line as at *a*. Trace upward to the curve for the desired number of cone steps and back gears as at *b*. Trace to the left and read the required ratio of successive speeds as at *c*.

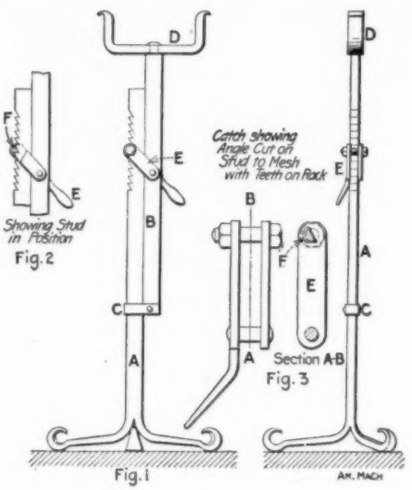
When finding the speeds by Professor Sweet's diagram (Fig. 2 of Mr. Halsey's article) take *d e* and *f c* of the chart respectively for *a b* and *b c* of the diagram.

An Adjustable Rest

By Jean Jean

The adjustable rest illustrated will be found very useful and quick in action for the machine shop or smithy.

The rest consists of a standard *A*, Fig. 1, which has three feet. At the upper end, the ratchet teeth are cut. Piece *B* is made from the same material as section *C*, riveted on its lower end as a retaining piece to *A*. The upper end of *B*



An Adjustable Rest

is turned, so that claw *D* may swivel round and adjust itself in position to the machine that it is being used with.

The catch holder *E* acts as a second relieving piece. Any weight applied on the top of *D* gives a downward pressure and thus engages the catch *F* with the teeth in the ratchet. To release it is only necessary to lift up the catch-holder handle, and thus slide up or down, as required, the piece *B*. Figs. 2 and 3 show plainly, in section, the form of catch *F*.

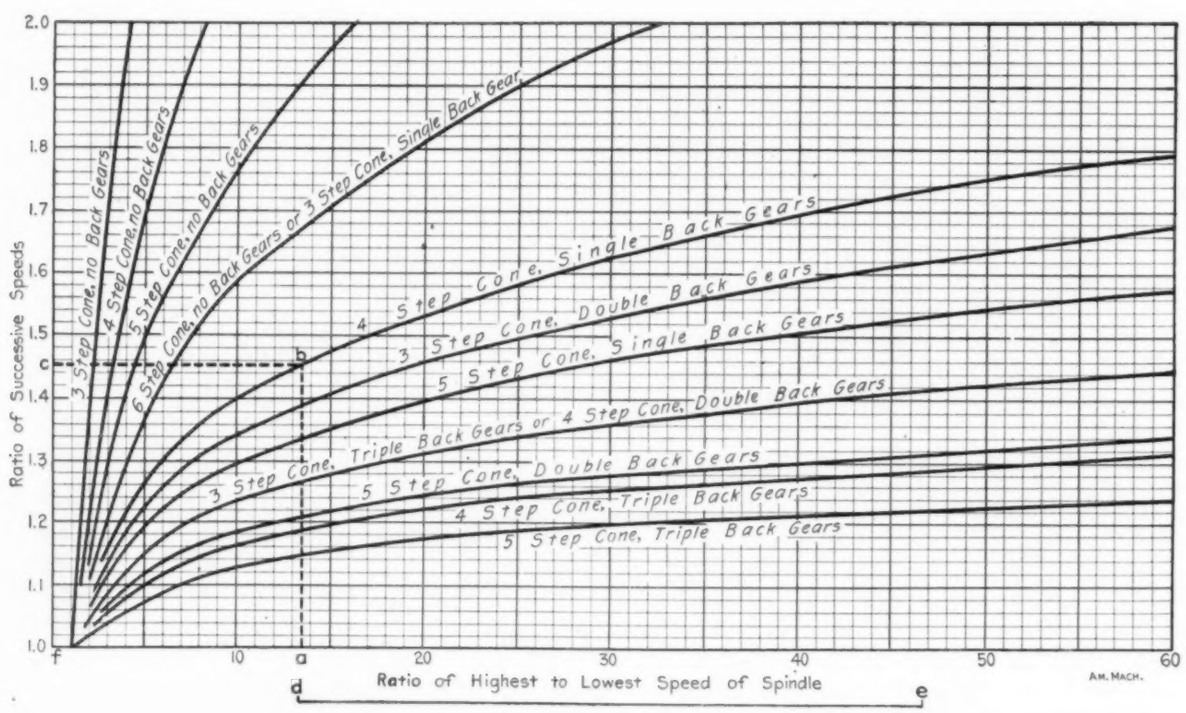


Chart for Finding the Ratio of Cone-pulley Speeds

Card Control of Work in a Small Shop

By Alfred Strong*

A practical and effective card system for tracking manufacturing operations, checking time, controlling supplies and regulating the office routine associated with every job.

*Manager, H. O. Strong & Sons, Ltd., Bristol, Eng.

There are few shops employing 100 hands that are able to run a manufacturing business without some system or other. The accompanying forms show a satisfactory method practically employed in a plant of this character. The system represents the gradual growth of a number of years, and every card and form has been thoroughly tested by experience.

Inquiries

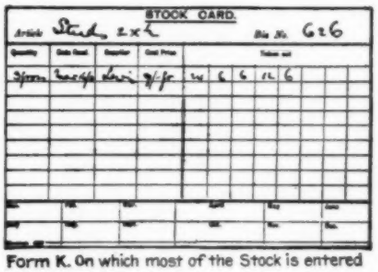
These are filed on cards, Form *A*, and indexed under the goods headings. The cards are periodically examined and marked. After a certain number of follow up postcards have been sent, or if the order arrives the inquiry is crossed out.

Ordering Material

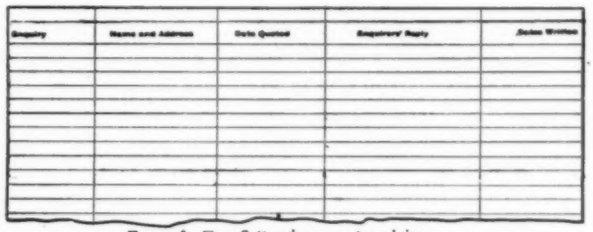
This is done on a triplicate system using Form B, one copy going to the supplier, one copy being retained in the office and one copy going to the storekeeper. When the goods are delivered, the storekeeper checks them with the order, which he initials and passes into the office. This is filed permanently and the office copy destroyed. This system safeguards against deficiencies of all kinds, is easy for reference and prevents goods being ordered more than once.

Plant Account

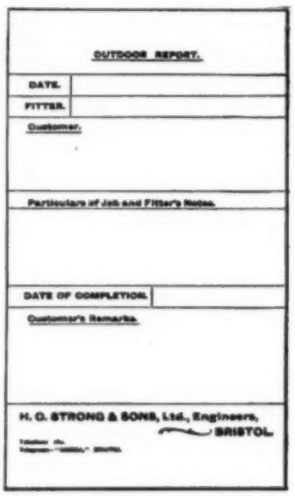
The entire plant is entered on a card index, Form P. The machines or tools are entered under the debtor account, and on that side of the card go additions, repairs and renewals. On the credit side of the card are entered the annual depreciation and also any special depreciation in the way of damage. On this side also a canceling entry is made if a tool is sold or destroyed. These cards are indexed under departmental headings, such as "Machine shop," "Erecting shop," "Toolroom," etc., with an alphabetical guide for each department.



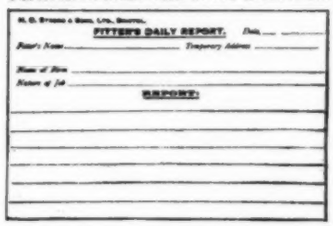
Form K. On which most of the Stock is entered



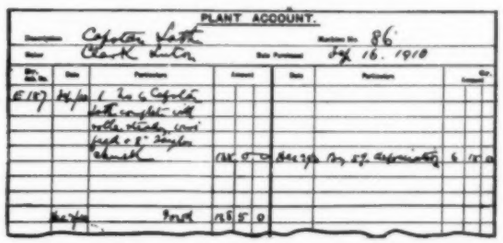
Form A. For following up Inquiries



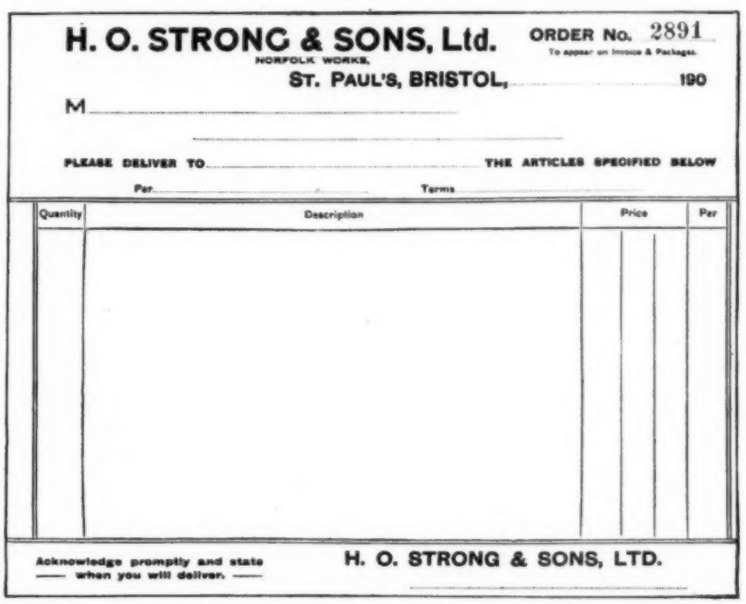
Form G. Supplementing Form O. 4¾ x 7⅜ in.



Form O. For Outside Workers, 5⅜ x 3½ in.



Form P. The entire Plant is Recorded on these Cards, 8 x 5 in.



Form B, 8⅞ x 6⅝ In., for Ordering Material

Callers

Every caller is invited to fill up Form S. It saves a lot of time and enables the principal to select useful interviews.

Stock Keeping

All stock, with the exception of a few items to which the system will not apply, is entered on the stock card, Form K, and indexed under goods headings. Monthly balances can be brought down, or, if preferred, the annual balance, only, for stock-taking purposes.

Buying Guide

Form N is used for this, the card being corrected from time to time, as

prices, discounts or conditions change. These cards are indexed, of course, under the goods headings.

Wage Record

The progress of each man is kept account of on a card, Form Q. All increases, the net hour rate, the establishment charge, total cost and the charging figure are all taken care of on this card.

Price Schedule

Each standard machine manufactured and each individual piece bears a number. This number follows the piece through the draft room, pattern shop, foundry and works. In the case of a customer ordering a duplicate part, the price of the part is determined for the office without waiting for shop costs to be made up. This enables invoices to go the same time as the goods. Form R is used in this connection.

General Order Book

In this book all customers' orders are entered, each entry carrying the details as to prices, discounts, terms, dates, and any other necessary instructions. In connection with this book the card, Form C, is issued to the works and bears all the information necessary to intelligently fill the order. When the job is completed, this card, with all the details filled in, is returned to the office on specific days, when all the charging is done.

Stock Order Book

In this book are entered all orders for batches of standard machines, and here also are collected the costs of each batch. The card, Form D, is issued to the works in connection with this book and is returned in the same way as the Form C, the order number being differentiated from customer's orders and "Establishment book" orders by prefixing the letter S.

Establishment Book

In this book are entered all repairs, renewals and additions to plant, and the card, Form E, is issued for every such der number to distinguish it from the job, the letter E being used before the order number, to distinguish it from the "General order" and "Stock order" books. This "Establishment book" occupies a prominent position in the determination of the overhead charge, as repairs and renewals are always considerable items. In addition, all unproductive labor is scheduled in this book. At the beginning of each year, pages are opened with such entries as "Grinding shop drills," "Sharpening milling cutters," "Drawing and pattern renovations," "Experimental account," etc. The importance of these entries is obvious, and each entry bears a number as though it were a *bona fide* job. it is possible, therefore, from a periodical analysis to see how each of these dead charges is developing. It also removes from the time sheet that always irritating item, "Shop work."

Instructions to Men

In the works all instructions to men are issued on Form F, this form being used in several sizes. Verbal instructions are avoided.

Stores Orders

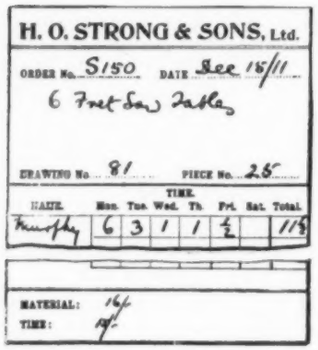
No material is issued from the stores without a signed order. Each night these orders are booked off by a stores clerk against the different orders to which they pertain in a "General material" book. The stock record (see form K) is also corrected each day from these orders so that the condition of the stock can be seen at once.

Time Sheets

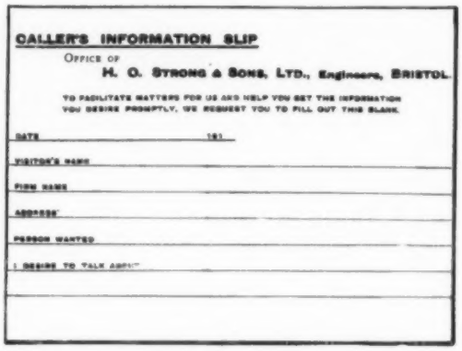
All time is entered by the men daily on Form J. All the time sheets are daily checked with the "Time register" sheet, and the time transferred to the different orders in the "General order" book, "Stock order" book and the "Establishment" book. The daily total is also entered in a "Wages" book in which the week's total, plus overtime, is carried out.

Report Sheets

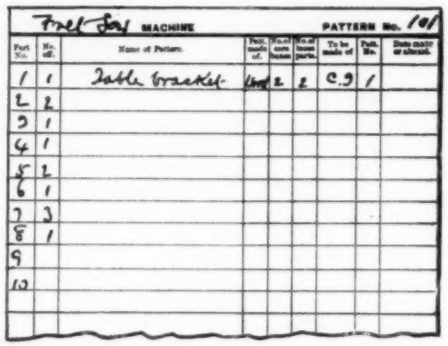
Fitters sent out for erection or re-


H. O. STRONG & SONS, Ltd.
ORDER No. S150 DATE Dec 15/11
6 Fret Saw Tables
DRAWING No. 81 PIECE No. 25
TIME.
NAME. Mon. Tue. Wed. Th. Fri. Sat. Total.
Murphy 6 3 1 1 ½ 11½
MATERIAL: 16/
TIME: 1/-

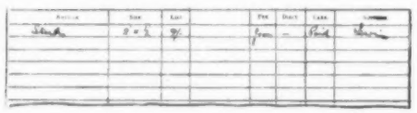
Form L, 3½x6 In., Follows Job All Through


CALLER'S INFORMATION SLIP
OFFICE OF
H. O. STRONG & SONS, LTD., Engineers, BRISTOL.
TO FACILITATE MATTERS FOR US AND HELP YOU GET THE INFORMATION YOU DESIRE PROMPTLY, WE REQUEST YOU TO FILL OUT THIS BLANK.
DATE 191
VISITOR'S NAME
FIRM NAME
ADDRESS
PERSON WANTED
I DESIRE TO TALK ABOUT

Form S, 5⅜x3½ In., a Slip All Callers Are Requested to Fill Out

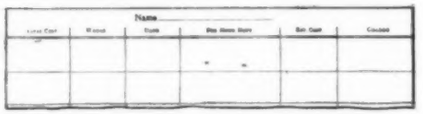

Fret Saw MACHINE PATTERN No. 101
Part No. No. off. Name of Pattern. To be made of Pattern No. Date made or altered.
1 1 Table bracket Cast 2 2 C.9 1
2 2
3 1
4 1
5 2
6 1
7 3
8 1
9
10

Form M, 5x8 In., Foreman's Information Card. Same Back and Front

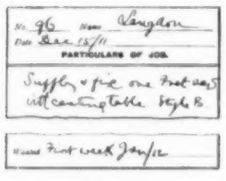


Form N, 8x5 In., for Recording Prices, Discounts, Etc.

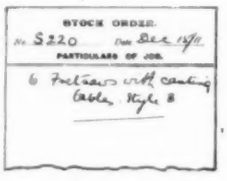
Form R, 8x5 In., Price Schedule for Standard Machines and Parts



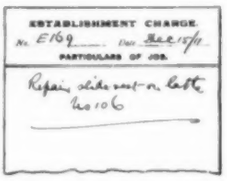
Form Q, 8x5 In., Wage Record, Embracing Job Cost



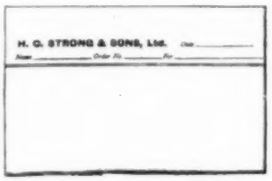
Form C, 4¼x5½ In.



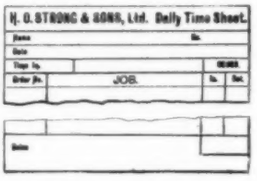
Form D, 4⅜x5½ In.



Form E, 4⅜x5½ In.



Form F, 5⅜x3 In.



Form J, 5x7 In.

pairs furnish a daily report on Form O and a final report, Form G, signed by the customer on completion of the job.

Costs

Complete costs of every individual job are kept, the time being posted from the time sheets and the material from the stores "General material" book, which, as shown above, is compiled from the "Stores orders." Thus the three order books to which reference has been made contain the complete cost of each job. In the case of standard machines, it is necessary, however, to know not only the complete cost of a particular batch of machines, but the cost of each piece in any individual batch. Form L therefore is issued by the general foreman with each batch of pieces. This card follows the job all around the shops, being transferred after each operation to the man in charge, the men filling in the time spent. When completed, this card is returned to the office, the time being totaled and the material taken from the stores "material" book.

It is possible by this means to locate with unerring accuracy any fluctuation in costs. As a general rule, if the completed costs, as disclosed by the "Stock order" book, are normal, the detail cards pass through with a casual examination; but should there be anything wrong, an examination of these cards inevitably shows what is the matter. This Form L is also used to correct and verify the price schedule, Form R.

Keeping Track in the Works

Reference has been made above to the fact that every piece has a distinguishing number which follows it from the drafting room right through. An epitome of all this information is contained in the card index used by the general foreman, and Form M shows one of the cards. This card is used by the foreman in keeping in touch with the different batches of machines as they go through the works, in ordering castings and making sure that all supplies are on hand. Without such control it would be impossible to know that all the different parts of the machine were ordered, or were in progress, or were progressing at the power rate.

Our overhead charge is checked every month, but there is rarely necessity to alter the rate more than twice a year.

A Plea for Industrial Perspective

By A. L. Haas

A criticism of contemporary shop methods in which the individuality of the mechanic is lost, his initiative threatened and his manual and mental perspective narrowed. Some sound sense on the subjects of independent thought and broader associations.

In a picture representation bad perspective is so apparent as to call forth comment even from the uninitiated. So true is this that the easier geometrical representation—isometric—has a sense of unreality.

The shop is another field in which the proper perspective has use and weight. We have entered upon a time of speeding up when, not only must a piece of work be done, but the method and operations necessary to accomplish it are specified. Individual mechanical skill is, to a large extent, superseded, so far as the actual manual worker is concerned.

Making a Machine of the Mechanic

This policy of keeping the skill of the operative entirely occupied in making good time per piece may be a serious loss to the engineering business when viewed from the widest outlook. Methods of production are getting into grooves (possibly perfect), machines are reading logical conclusions of output and complexity, and dexterity is threatened. The machine business will be in a bad way when it becomes an aggregation of mere machine tenders. This policy of keeping all noses from the highest to the lowest close up to the grindstone will surely lead to a condition of mental myopia.

Who were the founders of the concerns today having a worldwide fame? Mechanics, and those of the old school at that. Who brought the industry to its present highly skilled condition; who introduced the methods leading to reduction in price and advancement in idea; whose judgment guided the concerns to their present level. Mechanics! All-around men, in nearly every instance. Men who worked manually at a bench for a ten-hour day for several years. If modern methods render it impossible for similar training to be obtained, what about the future?

Judgment—that most valuable faculty which no diploma is evidence of, which no examination tests ever probe—was the possession of the old-time mechanic. Education cannot give judgment. Only the accumulated experience, subconsciously stored by a thoughtful mind, makes instant and correct decision possible. Memory passes examination tests, but mechanical judgment is so peculiar a blend that memory plays but a small part in the mental makeup of its possessor.

Bench and University Graduates

The trouble with the ordinary workman is that his expressions are apt to be crude and that he is inarticulate. Were he slightly more polished, able to express himself in terms more cultivated, it is possible that his lengthy practical experience would give him a lead over the college graduate. Another point about the man in the shops is that he suffers from too near a point of view, his perspective is incorrect as to distance. He frequently fails to understand that all work can be expressed in dollars and cents, and if it cannot be so expressed on the right side of the ledger, business must cease.

The graduate, owing to his wider education, should be able, after experience, to take wider views. There is no patented method of making an engineer; the men in the past largely came up from the bottom, starting at bolt tapping, while today starting at a higher level is the rule.

The difference between a mechanic and an engineer is largely one of attitude of mind and technicality. It was the privilege of one aspiring mechanic when apprenticeship was over, to work under a foreman of the right type. The chief lesson he imparted was the necessity of doing one's own thinking. "Think wrongly if you like, but think for yourself." When starting, he impressed upon the beginner that because a job was usually done in one way was not proof positive that it was the best or only way. A receptive mind is certainly the key to knowledge.

Individual Mechanical Skill

There remain, and will probably always remain, two or three fields where resource, skill and judgment are called continually into play: Repair work, outside erecting and tool making for special purposes. In no case is the structly limited man of any use. A man finds himself or he gets out. Repair work and outside erecting are not clean jobs, neither is the temperature regulated to suit the comfortably minded. Individual mechanical skill denied an opening in manufacturing routine can still find an outlet here.

This psychological possession must be of importance. Perspective views were more the rule in the old-time shop. Under later methods, where water-tight compartments are the rule, such views are more difficult to obtain. In this connection the technical journal is a necessity, not a luxury; the more diverse the business gets, the greater the necessity for careful perusal, tending to some extent to restore the complete view of associated and kindred things. Such study is well repaid in

a wider grasp of essentials. In fact it is doubtful if a single mechanic can afford the luxury of doing without such an easy substitute for a true university training in the interchange of ideas.

The Mechanism of Thought

The mechanism of thought, especially that brand of thinking leading to, and evolving, original ideas is possibly outside the pale of description. The fund of subconscious ideas, stored without effort from the pages of the technical press, plays a large part in forming the background against which such thought is formed.

It is advisable from time to time to severely cross-question and consider any reached end with a view to reconstruction. It is of value to criticize one's own efforts from another point of view. A going back process has a value not always appreciated. Tortuous ways and winding paths incorporated in a finished design are frequently met with where a step-by-step process, extending over some years, has been made.

These roundabout and doubled tracks occur more often than is readily credible. Having grown so and become fixed, they are apt to be overlooked when not essentials. Practically any shop can find these deviations from the shortest path and by consideration can cut corners.

This all bears on a perspective point of view. Frequently an entire stranger, both to the concern and the particular business, is able, solely because of his isolated and individual observation, to see where mistakes of considerable magnitude are being made and prescribe a remedy.

A Prime Minister for the Shop

As a concrete suggestion: In every works over a limited size, one man, capable and of the right temperament, would have the greatest value. He would have no assigned duties of any description, his commission would be a roving one. Costs, methods and prices should all be accessible to him. He should be essentially a man of leisure, not accountable for what he does. As a direct consequence, it is probable that after six months he would welcome a 48-hour working day. He should be at liberty to discuss their jobs with the men, and to see leakage of material, system or power. Able at will to experiment along promising lines. In every case the agreement of the shop and office should be necessary to sanction any change.

The suggestion-box system has come to grief in many cases. Here is a remedy: A live personal suggestion box giving sympathetic ear to all and everything. In this way the suggestions of the many might be turned into the developed suggestions of one.

Closer Contact of Men Desired

There are two ways in which improvements now lost might come into being. Manually working at the product brings in its train associated ideas, and the attitude and viewpoint of the unassociated beholder not responsible in any way. The first is the attitude toward his work that the ancient artist-craftsman had; he incorporated his ideas in his product. The second is expressed by the proverb that the onlooker sees most of the fame. By a combination of the two, the ideas of the actual inarticulate workman and the detached viewpoint of the mechanically-brained man of leisure, many problems might be solved.

To some extent it would restore the old direct master-and-man feeling. There is a difficulty in maintaining a large close contact with an impersonal, incorporated body of stockholders. Were the management crystallized in a personal touch, a man always on view accessible to all, the result would be of considerable moment.

It seems possible without releasing discipline to bring such a system into being, that is, if given the right man. There was once a different feeling in the little shop, where the boss himself worked; the contact point of master-and-man was then broad. Effort and skill met personal appreciation, and a feeling of friendship existed. Those times are gone, and in place of the old relationship there is a feeling of resentment and unrest. There is no personal contact point; injustice can be done without remedy. One old chief laid it down that no two men could be treated quite alike. Certainly no body of men can be ruled by a set of printed regulations.

The objection to this suggestion, no doubt, will be that such a combination of tact, enthusiasm, temperament and ability is not walking the earth. This may be so, but experiment along these lines may be worth a trial.

With everyone so heavily burdened in the day's work, that the sleep of fatigue is all that is left when it ends, is certainly not conducive to a perspective point of view. There is no time to originate, only time for relaxation. A standpoint giving perspective is necessary to every firm. The entire resources of the plant are not in the office, the boss' room or even over the drawing board. A closer personal association of the administrative and working forces must prove valuable.

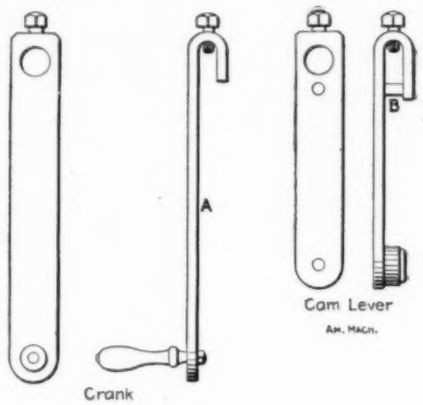
A Hurriedly Improvised Crank

By E. F. Cook

Some time ago while building some light automatic machinery, I suddenly found myself in need of a crank with which to turn a machine over to note the timing of certain operations, etc.

Nothing suitable could be found so I quickly bent a piece of ¼x1½-in. iron in the form shown at *A* in the diagram, bolted loosely on a file handle, drilled a shaft hole, put in a setscrew and in about 45 minutes the impatient inventor was able to see the wheels go round.

Recently the same device proved to be a life saver when a number of cam levers was needed on short notice. This time



A Hurriedly Improvised Crank

more strength was required and the return bend was continued far enough to permit riveting a spacer made from gas pipe in the position shown at *B*, making the lever very rigid.

The Origin of the Gimlet Pointed Wood Screw

By E. A. Dixie

One of the fables told me as a small kid was that the gimlet-pointed wood screw was invented by a woman.

While talking to a wood-screw maker recently he told me how this screw really happened.

Wood-screw blanks are held in a chuck and the cut starts at the head end and travels toward the point.

One of the operators had among other machines one under his care the slides of which were badly worn. As long as no chips got in the way the resistance of the metal in the screw kept the slide in its proper place, but a chip happened to fall just in the right position to jam the carriage just before the tool reached the end of the thread. In consequence of this the tool slide was swung in an arc and the result was a gimlet-pointed screw. The operator stopped the machine and showed the *defective* screws to the foreman. The foreman saw at once that a screw of this description would require no hole drilled for its reception. A piece of iron rod was secured to the slide with a C-clamp so that the tool holder would be positively swung at the proper point and a number of gimlet-pointed screws were made.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Threading Water Pump Valves

The water-valve seats in a number of pumps had become loose, due to the corrosive effect of salt water. It therefore became necessary to rethread the holes retaining the seats, and turn others to fit. Had taps been made to suit each of the different-sized holes in the various pumps, it would not only have been very costly, but the taps would very likely seldom find future service. The holes to be threaded were about 7 in. in diameter, through 1¼-in. cast iron with 10 threads to the inch.

The accompanying illustrations show the method employed. Fig. 1 shows the water cylinder and valves. Fig. 2 shows the material used. The equipment consists of one bar *A*, threaded 10 threads to the inch, which, when rotated by hand through the threaded collar *C*, will cut the same number of threads in the valve-seat hole, V_2, Fig. 3, as there are threads on the bar. Fig. 3 shows the idea to better advantage, the device being clamped to the pump ready to thread.

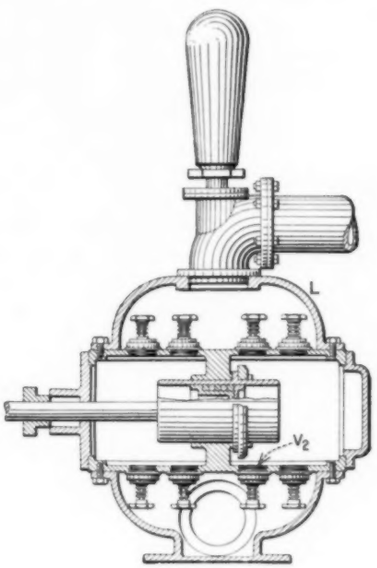
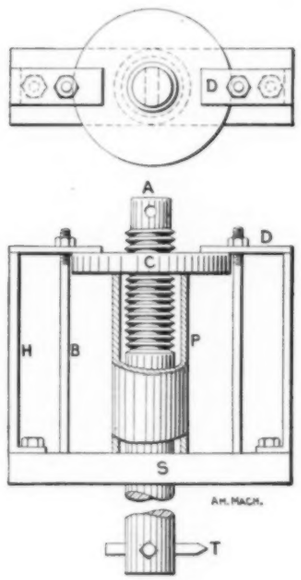


FIG. 1



THREADING WATER-PUMP VALVES FIG. 2

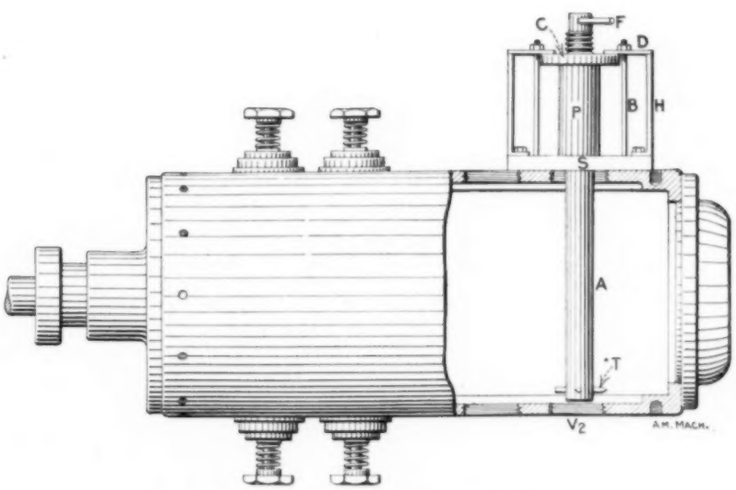


FIG. 3. THREADING WATER-PUMP VALVES

A hole drilled through the bar to facilitate turning it by hand, is shown at *E*. *S* is a piece of substantial flat iron bored a nice running fit. Its duty is to steady the bar and hold it central. In fastening it to the pump, the bolts or studs used in securing the water-chamber cover, *L*, Fig. 1, may be utilized. *P* shows a piece of pipe, on which collar *C* is securely clamped by clamp *D*. *E* is a clamp bolt and *H* the heel for the clamp. The tool *T* is fed to its cut by a light hammer blow.

These holes were threaded standard pipe taper, ¼ in. to the foot, the thread being first put in straight. Then the tool was fed into its cut a certain amount and the bar screwed through collar *C* to within a half turn of coming through the valve seat, hole V_2. The bar was then screwed out and the tool fed in again by a light hammer blow, the bar being screwed into the hole this time to within one turn of coming through, and so on until the job was complete.

The tool was not fed in at random each time, but an exact distance, it having been calculated just what amount would be necessary to bring it out the right taper. In making the seats to fit these holes, a template was first made by screwing a piece of wood into the hole. This gave the size to a nicety, and the brass seat was turned duplicate without any trouble.

ROBERT FULLERTON, JR.
Woodbridge, N. J.

A Continuous Inventory Record

The two simple blanks shown in Figs. 1 and 2 were designed to eliminate the repetition of names when taking an inventory. Of course, the rough and finished stockrooms are, or ought to be, taken care of by a perpetual card inventory. The machine-tool equipment, belting and shafting are corrected daily or weekly in their own loose-leaf book or set of cards, all of which may be easily brought together by a stenographer. For yearly comparison, Fig. 1, may be used in copying the stock cards, if these cards do

not already provide for such a comparison.

In Fig. 1 the first column provides for the names of the articles. Each succeeding column, taking care of a year, provides for the number of articles, unit price and total price. The narrow column takes care of the per cent. of depreciation, if any, for each article. If an article does not appear any one year its

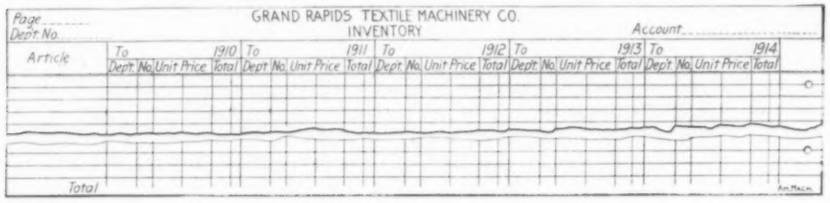


FIG. 1. FORM FOR CONTINUOUS INVENTORY RECORD

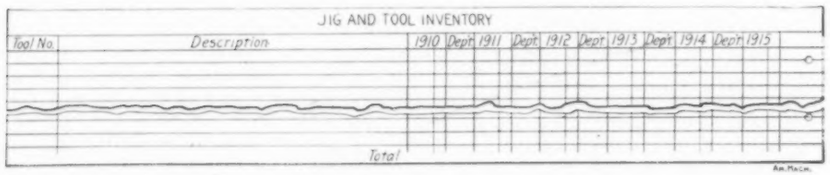


FIG. 2. SPECIAL FORM FOR TOOLS AND JIGS

space is, of course, left blank, and new leaves are inserted to take care of additions in each department. Each column is totaled at the foot but not carried to the next page, these totals being computed on the adding machine, using the subtotal key for department totals. This method eliminates carrying and adding large amounts and saves space and mistakes. The use of the subtotal key means only a simple subtraction after passing the first department.

The sheet, Fig. 2, is used in a similar manner, but is made especially to take care of tools and jigs. If the jig has been superseded during the year, its space is left blank and the total amount of loss thereby sustained is easily figured. The blanks may be any convenient size to fit your own standard binder size and a proper index for departments should be provided.

CLAUDE J. FRY.

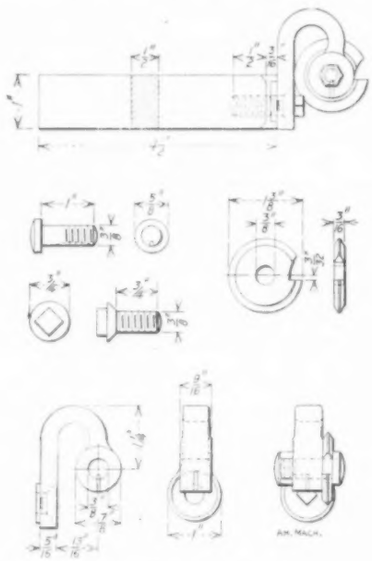
Grand Rapids, Mich.

A Spring Threading Tool

This tool is for cutting taps, screw gages and other parts where accuracy is desired. It has all the advantages of a spring tool and is equipped with a removable cutter, which can be sharpened and replaced without resetting. It has a further advantage over other thread tools in grinding or sharpening to any desired degree, as one need not depend on any thread gage or center gage.

The cutters are first turned and hardened, the hole lapped, and the faces ground parallel. Then they are placed on an arbor, and ground to the proper angle and to a perfectly sharp edge. In order to give clearance, the cutters are ground on a line $\frac{1}{32}$ in. below, and parallel to the horizontal diameter.

When grinding, the center of the grinding spindle should be dropped $\frac{1}{32}$ in. lower than the center of the cutter arbor, in order to get the proper clearance at this point. If the cutter is to be made for U. S. standard threads, after grinding it to a sharp edge, it should be carefully measured on the diameter, the amount of



A SPRING-THREADING TOOL

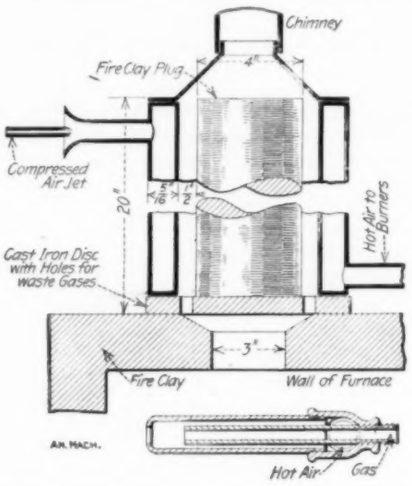
flat subtracted therefrom and the sharp edge reduced to this dimension. The diagram plainly shows the construction of the holder, by means of which the cutter can be tipped for right- or left-hand threads.

Waterbury, Conn. R. W. DRUFA.

Increasing Gas Furnace Temperatures

The following is a description of an air heater which I made to increase the temperature of a gas furnace in which which before any alteration was made, not more than 1600 deg. F. could be obtained.

At that time the furnace had only one



INCREASING GAS-FURNACE TEMPERATURES

burner and that was supplied by compressed air from the shop main. The first alteration was to make two burners with pieces of gas pipe, reduce the T-pieces and supply the air by means of a compressed-air jet as shown. As the gas supply, however, was insufficient the result was still unsatisfactory.

I then decided to make the air heater illustrated. The air in this enters at one side of the cylindrical heater and swirls round the walls at a high velocity, the air space being very narrow in order to bring all the air into contact with the heated part. We can now get a temperature of between 2300 and 2500 deg. F. inside the furnace.

Glasgow, Scotland. H. W. YOUNG.

Cutting a Cam in the Shaper

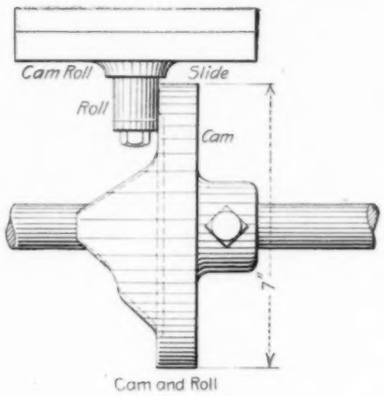
In experimenting with an automatic machine it became necessary to recut one of the cams, and as the only miller on which it could be done was set up and tied up on an important job, it was decided to recut on a shaper.

The cam and its roller are shown in Fig. 1. The machine was a very old one, and had a cylindrical cam roll instead of a cone. This made a rubbing contact on the cam, instead of a true rolling contact, but the work was very light, the roll-slide being pulled back by a spring. If it had not been a cylindrical roll it would have been impossible to cut the cam on a shaper.

The outline of the cut was marked on the cam, and the cam was placed in a

swivel vise in the shaper, the vise gripping the hub with V-blocks to prevent turning. The back of the cam was then blocked and wedged true to prevent tipping, care being taken to set the cam central over the stud about which the vise swiveled.

A round cutter, the size of the cam-roll, was used, and the shaper knee carefully adjusted so that the line of the cutter travel passed over the center of the cam, and the knee clamped to prevent it shifting. The ram head was then set to an upright position to feed vertically, and the job was ready for work. Two men were required to do the work, as will be seen.



Cam and Roll
Fig. 1

The Tool
Fig. 3

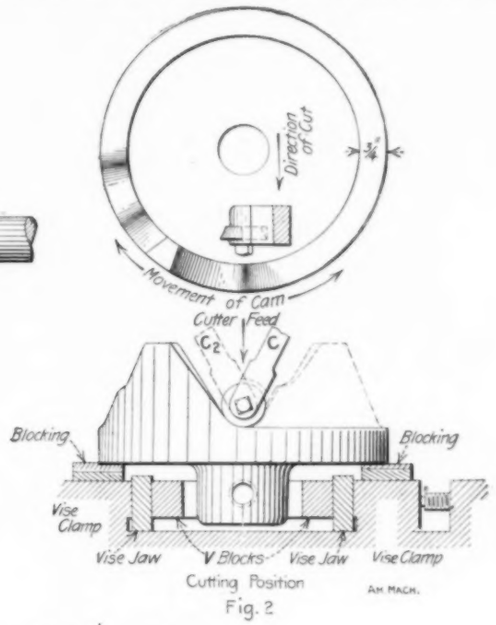


Fig. 2

CUTTING A CAM IN THE SHAPER

The vertical travel of the cutter corresponded to the travel of the roll, and by turning the vise, a motion corresponding to the movement of the cam was obtained. The cutter travel was operated by the regular head feed, the clapper being set over to clear on the return as shown by C and C_2 in Fig. 2.

A lead hammer was used to lightly tap the vise screw sideways to obtain the circular feed of the vise. During the cutting stroke it was necessary to clamp the swivel by means of the clamping lever under the knee, and when turning the vise for each feed, it was necessary to loosen it; this required a man to work the clamping lever while the regular operator attended to both feeds.

By taking a light finished cut, and dressing with a file, a smooth, true surface was obtained and a perfectly satisfactory job turned out.

The tool is worthy of mention, and is shown in Fig. 3. The holder is of a size to suit the tool post, and is upset at the cutter end for the larger cutters only. The slot for the cutter should be above the center of the holder, to leave stock heavy enough back of the tool to withstand the cutting strain.

The cutters are tool-steel disks from $\frac{3}{16}$ to $\frac{1}{4}$ in. thick, with a central hole for the clamping screw and are ground to size after hardening. The only disadvantage of this cutter is that it cannot be ground without changing its size, but if made of high-speed steel it stands up very well, and when one-half is dull, the other half edge may be presented to the work, and finally the entire cutter may be ground down to the next smaller size.

In Fig. 2 the cutter is shown at the bottom of the cut. The cutter was started at the top, or point, of the cam, and fed downward, and the cam revolved away from the cutter, so that in case the "sledge-hammer adjustment" was too violent the cutter would not dig in and spoil the cam.

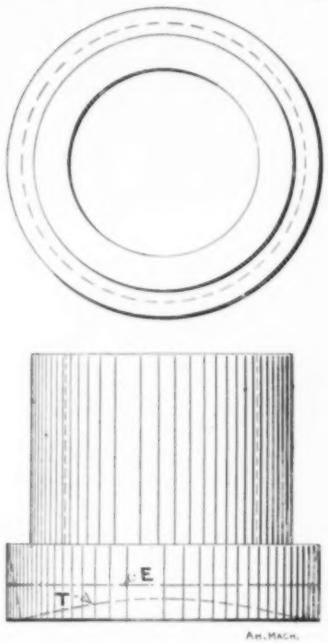
Cleveland, O. C. F. SMITH.

"Heart Trouble" in a Brass Casting

All brass castings have hearts. The little brass casting shown in the diagram developed an acute case of "heart trouble" that took the conceit out of the whole foundry force, regardless of whether they believed in educated sand rammers or not.

This casting consisted of a hollow cylinder, about 2x2 in., with a solid flange at one end. The flange had to be machined, rounding the edge as shown by the dotted lines, and a nice polished finish given to the whole surface. The flange was about $\frac{1}{4}$ in. thick in the rough. About one-half of this thickness was removed by the lathe, and herein the trouble developed. The lathe showed up a rough surface on the face of the flange and fed the scrap pile at a joy-rider's rate, though the skin of the casting seemed sound enough.

In other words, the heart of the casting, as shown by the line E, was cut into by the lathe tool, and the face would not finish smooth. Various mixtures, temperatures, sands, facings, gates, etc., as well as the usual habit of blaming the other fellow were tried, without any luck. But after making a study of the fundamental principles of casting structures, a cure was effected by making a trifling change in the form of the pattern.



HEART TROUBLE IN A BRASS CASTING

The face of the flange was cupped slightly, as shown by the curved line T on the pattern. This expedient caused the heart to locate farther up and the machining could be done in solid metal.

Scranton, Penn. F. WEBSTER.

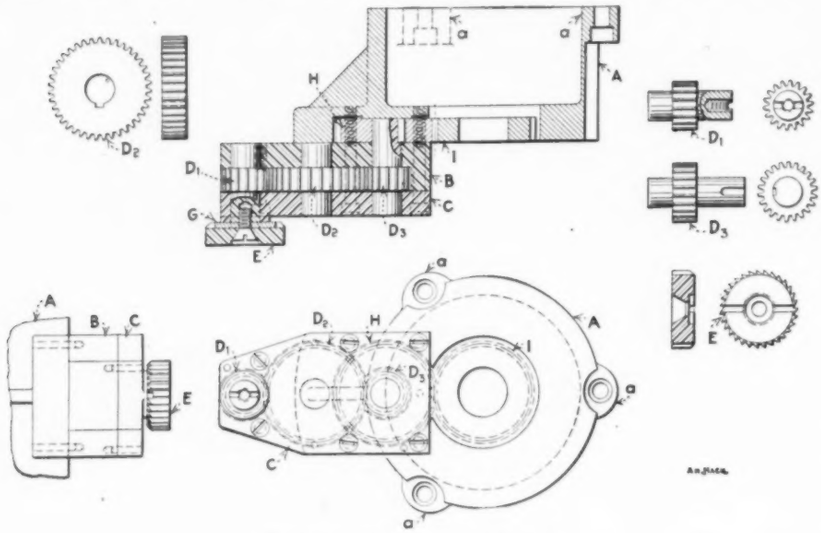
Milling in a Limited Space

The accompanying line-cut shows an attachment used in connection with a plain miller for milling a portion of the surface of a grid casting. The piece in question is of a good grade cast iron, and has a number of lugs or pillars projecting at right angles from its base surface. Located among these numerous projections are several spots requiring a finish cut. This fixture was designed to finish one in particular where space was limited.

The casting A carries the two steel plates B and C and between B and C lie three steel pinions D^1, D^2 and D^3. The arbor portion of pinion D^1 is drilled and tapped so that the cutter E can be screwed tightly in place as shown, being keyed to the arbor by the key G. The arbor portion of pinion D^3 carries at its inner end the gear H which meshes with

a similar gear *I* mounted on a special miller arbor and keyed thereto.

The casting *A* has three projecting lugs *a a a* which are drilled and counterbored to receive screws, by means of



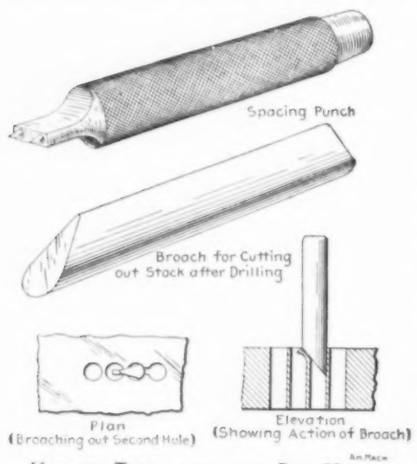
MILLING IN A LIMITED SPACE

which the fixture is attached to the column of the miller. The device being in position and the machine set in motion, the rotation of the spindle is transmitted through the train of gears to the cutter *E*. The castings to be milled are mounted upon a special angle plate on the table of the miller and the cut is made by feeding the work up to the cutter in the usual manner.

Springfield, Ill. F. W. BROWN.

Useful Tools for the Die Maker

Here are two inexpensive tools for die makers. I have found them very valuable as timesavers, the broach, espe-



USEFUL TOOLS FOR THE DIE MAKER

cially, being a tool that can be used in some of the most delicate dies.

Every tool maker should not have less than three sizes among his kit of tools. Useful sizes for the spacing punches are, $^{9}/_{64}$, $^{13}/_{64}$ and $^{17}/_{64}$ in. center to center, to suit drills $\frac{1}{8}$, $\frac{5}{16}$ and $\frac{1}{4}$ in. The broaches should be made from drill rod the following sizes: $\frac{5}{32}$x1 in. long, $\frac{7}{32}$x1¼ in. long, $\frac{9}{32}$x1½ in. long. These tools may not be new to some in the trade, but from experience I find them very little known.

CHARLES E. SMETHURST.

Detroit, Mich.

Common Sense and Gear Troubles

The question of silent gears brings others in its wake. Without going into pressure angles, constant or varying velocity of tooth action, generated or formed teeth, there are many places where a little horse sense will help out wonderfully.

When a pair of gears fail to run as quietly as desired, the custom is to blame the man who made the cutters. The fact that he had made cutters for years and still makes them for some of the fussiest people, does not seem to count.

If he is perfectly frank he will admit that his cutters are not perfect, that they spring some in hardening and that even if he grinds them afterward, there is still a chance for some error. But he will also probably tell you, unless he is more careful of your feelings than you are of his, that the error in any cutter which gets out of his shop is probably much less than your error in cutting or sizing.

One of the best mechanics I know had some gear troubles and suggested a solution in the shape of modified gear teeth to suit his work. The gear cutter told him that the idea was all right, that the gears would make little noise or chatter and that he would make the cutters to do the work. But he also called his attention to the fact that making the right gear cutters was only part of the job; that a little inaccuracy in the spacing would offset the advantages of the special form of tooth and also that center distance, the springing of shafts and the way the bearings were supported, all had their effect. So new index plates were ordered and extra precautions taken, the result being extremely satisfactory gears.

Contrast this with the man who thinks he knows it all. He would have ordered gear cutters according to his own ideas and cut his gears on any available old machine. Then he would have complained of the cutters, ordered more from some other maker and so on. In a short time he would have been convinced of the general ignorance of all makers of gear cutters and have advertised it to the best of his ability.

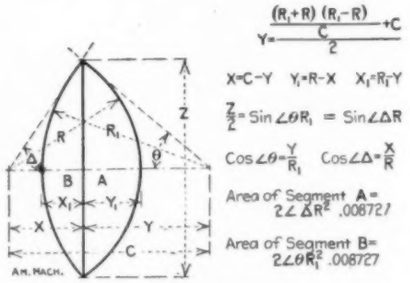
Leaving aside the wear and tear on his alleged mentality and disposition, he would have spent more money, counting time lost, than the new index plates cost, and would not have been much, if any nearer good gears than before. Altogether it is one of the cases which show how many different factors affect good workmanship and that it is not safe to blame any one factor until we are sure that the others are not affecting the result also.

JOHN R. GODFREY.

New York, N. Y.

A Drafting Room Chart

The chart shows a concise method of finding the combined area of two inter-



A DRAFTING-ROOM CHART

secting segments. It is a handy addition to a draftsman's set of tables.

HENRY R. BOWMAN.

Watervleit, N. Y.

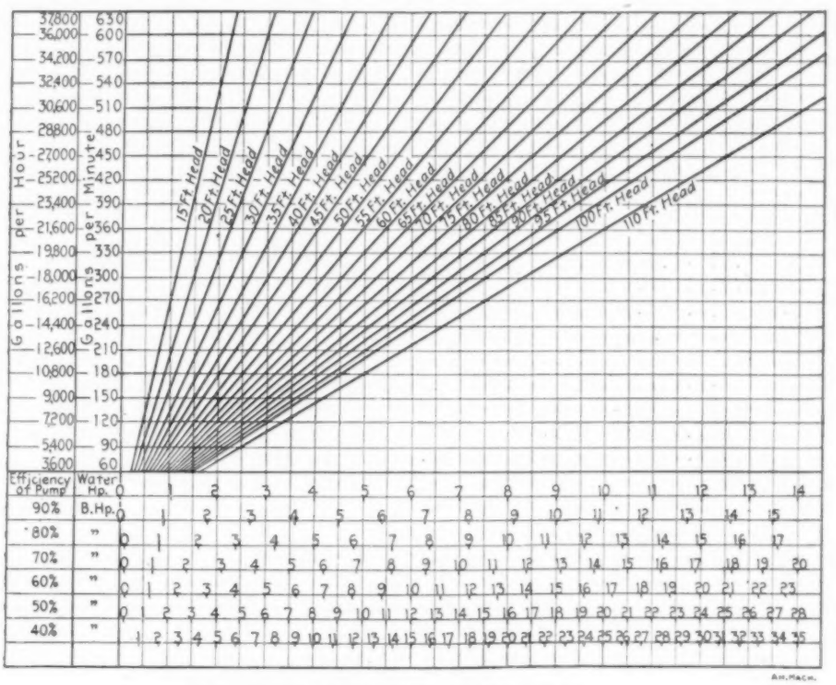
A room may be too damp for human occupancy, without showing the growth of molds or mildews, or the formation of crystals upon the walls. In order to test the habitability of a room with respect to humidity, *Le Journal de la Sante* recommends placing about two pounds of freshly slacked lime in the room, sealing up all doors and windows tightly, and leaving for twenty-four hours. If the increase in weight during this time (absorption of water) exceeds 10 per cent. of the weight of the lime, the room should not be considered healthful.

Discussion of Previous Question

Referring to letters and articles previously published

Pumping Diagrams

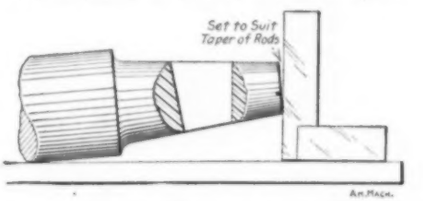
On page 191 we published some pumping diagrams, contributed by W. E. Wort. The gallons per hour, as we should have stated in connection with the diagrams, were expressed in Imperial gallons. In repeating these diagrams, we are expressing the capacities in U. S. Standard gallons.—EDITOR.



PUMPING DIAGRAM, 15- TO 110-FT. HEAD

Drilling Taper in Keyslots

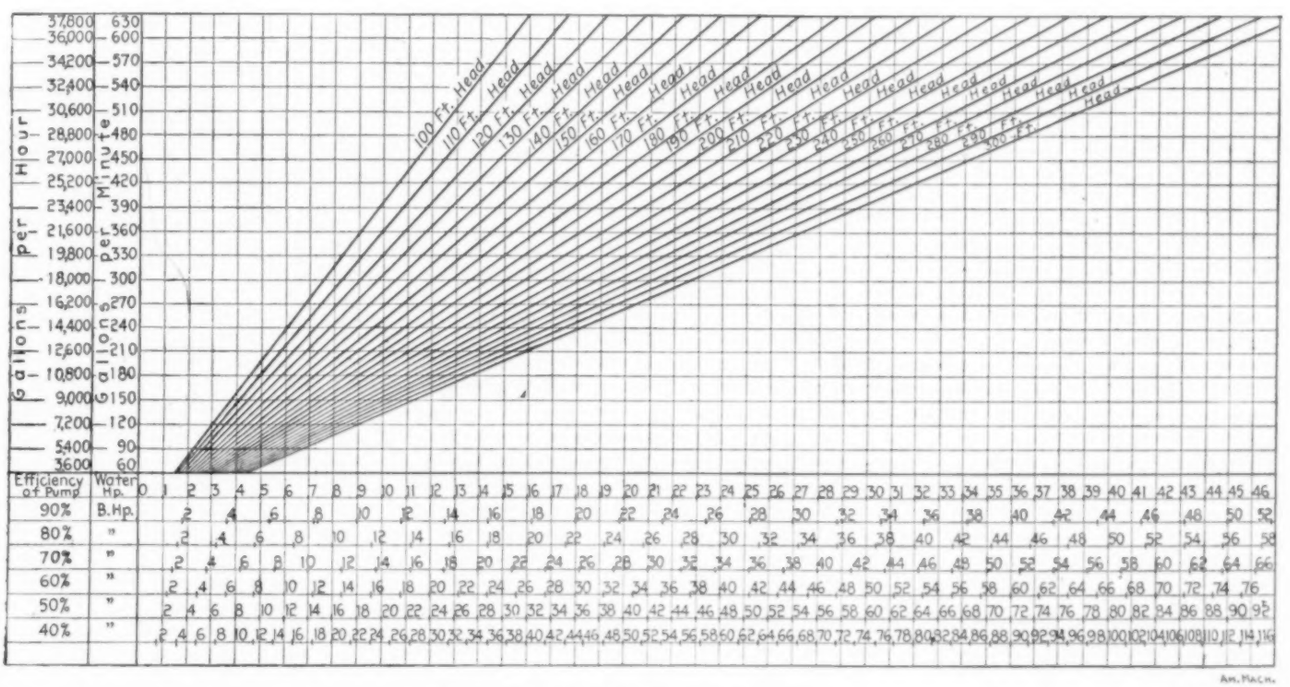
In Vol. 35, page 697, under "Key Slots in Piston Rods," Andrew Harvie gave a sketch of a two-point bearing for filing taper in the keyway of piston rods. I would suggest that the next time he has a taper to put in a keyslot he set the rod to



DRILLING TAPER IN KEYSLOTS

suit the taper in the keyway, as shown in the illustration, and as most all keyways of this kind are round at each end the drill will make the proper radius and not leave much filling.

It occurs to me that machine-tool builders should standardize the keyways for cross-keys in spindles of all machines. This would be a great relief to the toolroom and to the machine operator. As it is at present a large shop is required to carry an immense number of exten-



PUMPING DIAGRAM, 100- TO 300-FT. HEAD

ion sockets, collets and special boring bars. The same thing applies to the size of lathe centers.

Would it not be a step forward for them to take up this question? The time is not far distant when the buyer of a machine tool will order his lathe or miller spindles of a taper corresponding to the size in use in his works. The same thing applies to tap squares; no two tap makers put same size square on their taps.

A few months ago you discussed end mills and right- and left-hand spiral cutting on a right-hand mill. Brown & Sharpe upheld the left-hand, saying a right-hand spiral would not work. This I have demonstrated in the past three years and would not think of using a left-hand spiral on a right-hand mill.

Philadelphia, Penn. T. A. WALLACE.

Standardization of Machine Tools

Under this heading W. F. Schellenbach discusses some of the features of the design of machine tools, in Vol. 36, pages 89-91. In general, I consider Mr. Schellenbach's suggestion worthy of attention and timely. However, I desire to take exception to the manner in which he assumes to draw conclusions in that section of his article regarding geometrical progression for feeds and speeds.

The speeds he gives for a driller and which are arranged in geometrical progression as follows: 20, 32, 51, 82, 131, 209, 335, 536, he says are correct for carbon drills of the following sizes: 5½, 4⅛, 2⅝, 1⅝, 1, ⅝, 3/8, ¼ in. I desire to raise the question as to his authority for stating that these speeds are right and others are not right. For example: In the same paragraph he says, "What shall we use for drills of the following sizes: 7/16, ½, 13/16, 1 1/16, 2⅛ and 3 in., etc?" These speeds, and the drills mentioned suitable to them, show a standard speed in feet per minute of 35.

Mr. Schellenbach does not indicate that the driller to be designed under these speeds is to be a single-purpose machine; that is, to work on cast iron only. Moreover, the manufacturer can never foretell exactly the field of operation or the usage his product will have. It may be that this drill would be used on brass, bronze, cast iron, machine steel, alloy steel or tool steel, in each of which metals the speeds of drills are greatly reduced in the order of the metals given.

The empirical number, of 35 ft. per minute, is not a hard and fast rule, nor will it be a sufficient guide to a man in designing a machine which is not limited to a single purpose, or for operations in certain narrow ranges.

The third paragraph in his discussion cites an example of a 20-in. lathe with a five-step cone, and a single back gear, arranged in geometrical progression. The assumption is made that this lathe should operate at 50 ft. per minute and is therefore suitable for only ten certain diameters. In the following paragraph the query: "What shall we do for other diameters than those mentioned as suitable to a speed of 50 ft. per minute?" is raised. For example: 1⅜, 3, 4½, 7, 10 and 15 in., for which we have *no correct speeds*.

The empirical figure of 50 ft. per minute will not even apply to all cases where carbon-steel tools are used on cast iron or mild steel, to say nothing of the probability that other metals, both harder and softer, will be machined in this lathe. Also other conditions affecting the speed, such as depth of cut and the condition of finish, will not permit us to say that 50 ft. per minute is the speed at which this lathe should run.

In general, then, it appears to me that the points to be observed in designing machine tools relative to their speeds can be thus stated: Consideration should be given to the materials which are to be cut on this machine and the speeds at which it is possible to cut them, and in the case of a lathe, the diameter capacity of the lathe. With these figures at hand decide what are the highest and lowest probable speeds desired, then give consideration to the design of the speeds of the machine between these limits.

Of course, do not consider extreme limits. For example: A customer buying a 16-in. quick-change lathe designed for metal turning, asked if this lathe would stand service at 1500 r.p.m., stating that he desired to do pattern work on it. An extreme like this cannot enter into the design of a multipurpose machine.

THE RELATION OF SPEEDS

Having arrived at the range of speeds which will be given the machine, the next feature is to determine the relation of these speeds one to another. There is no rule for the relation of speeds which is of larger service or applies more satisfactorily to the determination of a series of speeds than that of geometrical progression. Other progressions may be assumed, but anything outside of geometrical progression will probably result in a small difference between certain speeds and a great difference between certain other speeds.

Geometrical progression passes by regular steps through the path of infinitesimal progression, obtained only on the several makes of taper pulleys and friction drives, and cannot be applied to step-cone pulleys or the changes obtained by gear drives. Any other progression will not follow such a path; and to say that carbon drills are to be run at 35 ft. per minute and that any other approximate speed is wrong, is as absurd as it is to say that any other than a lathe cutting speed of 50 ft. per minute is wrong.

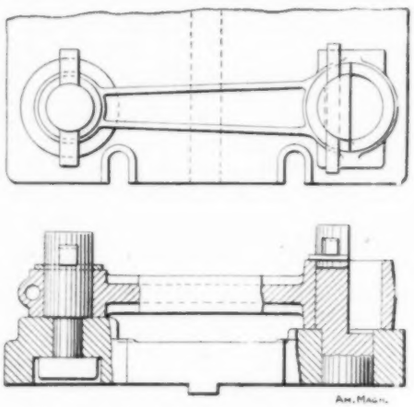
R. H. WADSWORTH.

Gen. Supt., Seneca Falls Manufacturing Co., Seneca Falls, N. Y.

Splitting Connecting Rod Caps

I noticed in Vol. 36, pages 81 to 84, an article by F. A. Stanley, entitled "Methods in the Dorris Motor Car Shop." I cannot, however, see anything modern about Fig. 12, page 84, "Fixture for Splitting Connecting-Rod Caps."

It is very apparent that it would be a rather slow process, as it would be necessary to remove and replace all the screws



WEDGES FOR SPLITTING THE CAPS

and nuts used in securing the connecting rods to the milling fixture every time one set of rods had to be removed and replaced. Would it not be more rapid to use wedges, as shown in the diagram?

C. E. BERG,

Supt., Ottumwa Iron Works, Ottumwa, Iowa.

Cutting a 127-Tooth Gear

I think that "enormous" is a rather heavy adjective to use to describe the amount of work involved in turning a 22-in. gear blank to fit a ½-in. pitch roller chain, as described in Vol. 35, page 798. The way out of the difficulty, described by Mr. Betz, on page 1135, is, unfortunately barricaded by an "if." It is some time since I have used a Brown & Sharpe dividing head, but I think that I am right in saying that the method of compound indexing referred to by Mr. Betz can only be used on a Brown & Sharpe universal dividing head.

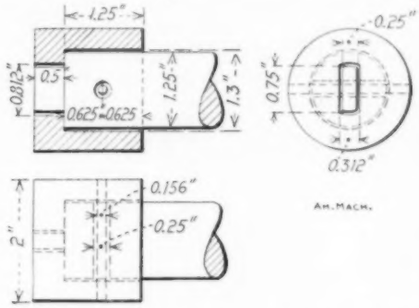
Granting any head fitted with an extension to the spindle, it is a simple matter to set it up with the gears supplied with the machine, to cut 127 teeth exactly—not approximately—by the differential method which is much more convenient than the compound method and does not give one 127 chances of making a mistake.

London, Eng. A. RAYMOND.

Floating Arbors

The floating arbor and reamer has had considerable attention in the AMERICAN MACHINIST. I have read those discussions with much interest.

There are "floating" arbors which do not float, but simply have an end movement describing a circle from a fixed center. A simple type is with a loose fitting parallel socket having a driving peg which also takes the thrust, and a clearance hole in the arbor. For heavy driving the tendency here is for the peg to shear, or if not to shear to distort, thereby locking the arbor movement or float.



ARBOR SOCKET PROVIDING AMPLE FLOAT

The diagram shows an arbor socket I designed, which has certain advantages. In this case the thrust is taken on the inside shoulder and ample float is provided inside the socket. The tang end of the arbor engages in the socket slot, thus the drive is insured, while the possibility of a negative float is entirely eliminated. For driving purposes the peg is inactive, merely serving to keep the socket and arbor attached.

ANDREW WEBSTER.

Glasgow, Scotland.

Drafting Room Speed and Accuracy

While "Entropy," according to his article, "Efficiency in the Drafting Room," Vol. 36, page 199, may firmly believe that speed has nothing to do with drawing-office efficiency, yet the fact remains that in actual practice it has a good deal to do with it.

The thread which runs through all our commercial dealings today is service in some form or another. A commercial organization could not live unless it rendered service to another.

In considering this main factor of service we should not forget that it is made up of several items. Not only are the quality and price of the goods delivered to be considered, but also the manner and speed of the service.

Today, more than ever, the business man's motto is, "Do it now," and along with that he expects to "Get it now," when he places an order. This means that when a company takes an order which calls for a short delivery, and perhaps entails work in the drawing office, the latter is supposed to do its part quickly as well as correctly. Upon its speed also depends the total efficiency of the service that the company is able to render.

Very often the only way in which a company can land an order is by rendering quicker service than another. We cannot blame the buyer. If you go into a restaurant and there is delay in filling your order you know how mad you get about it. The commercial order is only the same case on a larger scale. Speed as a part of the efficiency of service has come to stay and the drawing office has got to come up to modern standards.

One more thought: Are you sure that the slow thinker is the accurate one and that the fast thinker is an inaccurate one? I doubt it. The accuracy of thinking is independent of its speed. It is a matter of habit and training. Correct thinking combined with long training has everything to do with the making of a rapid, accurate mind.

It is needless to add that a large amount of time in the drawing office can be saved by the method of handling the work, by having trained men familiar with your work, by the correct use of instruments and, not least by any means, of having a group of men who will work well together.

St. Louis, Mo. E. L. COOLIDGE.

Locating and Boring Holes in Jigs

In the above-named article in Vol. 35, page 1232, by G. F. Oliver, the author suggests that the best method of boring jigs or dies, where any degrees of accuracy is to be obtained, is on the miller. He further goes on to explain that the way he gets this accuracy is to chuck a piece of steel or brass, turn it down and measure it and if it is not as required, repeat the operation of turning until the desired result is obtained. He is then ready to strap down the jig and take his measurements from whichever end of the jig he takes for his base of operations; and when he has his distance correct he is ready to drill and bore.

LOCATING AND BORING HOLES IN JIGS

My experience is that instead of chucking a piece it is best to turn down a piece of tool steel to fit the spindle of the mill; and leave about 4 inches standing out, as per the illustration, one part turned down to 1 in. and the other turned down to ½ in., of course making the usual allowance for grinding. Then instead of putting on the vise, chucking and turning down a piece of stock several times until it is true all that is necessary is to put the arbor into the spindle of the miller and start work at once with the assurance that absolute accuracy will follow.

Springfield, Ohio. WALTER J. OLES.

[Mr. Oles overlooks the fact that it is impossible to set a tool such as he describes, so that it will run absolutely true by simply inserting it in the spindle as he suggests. The only way to insure a plug running absolutely true is by turning it true each time as outlined by Mr. Oliver, though for some work where only a fair degree of accuracy is necessary, the tool shown will do very well.—EDITOR.]

Another Tool for Boring Jig Plates

The tool for boring jig plates for the driller or miller, shown in Vol. 34, page 1175, requires a skilled workman or experienced machinist, since it is essential that the width to the proper diameter be located just right. A method which I have followed for a good while has proved satisfactory for simplicity and cheapness. Moreover, the successful use of the process is in every way independent of the greater or less skill of the workman.

ANOTHER TOOL FOR BORING JIG PLATES

In every machine shop, as a rule, a driller or miller is used to bore jig plates. For many years I have used for this purpsoe the so called floating arbor, shown in the accompanying diagram. It contains a slot *A*, cut in with a flattening *B* on both sides. In the slot is gripped the cutter *C*, fastened tight by a wedge *D*. After insertion of the cutter it is turned off, hardened and ground. The slot in the arbor allows an interchange of the cutter, whose diameter obviously corresponds with that of the hole for which it is to be used. It is a good idea to bevel off the cutter in front, since the jigs are scribed; it may thus be seen whether the adjustment is accurate. I should not neglect to mention that the floating arbor is stout enough to guarantee unquestionable stability.

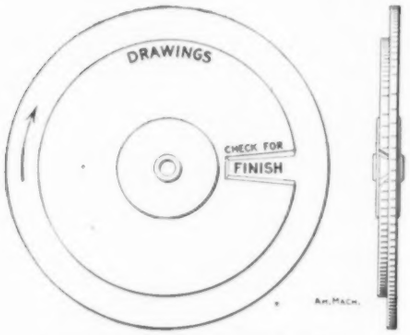
Hamburg, Germany. G. ROBIE

Another Method for Checking Drawings

Mr. Kavanagh's article in Vol. 36, page 54, entitled, "A Method for Checking Tool Drawings," very clearly brings to

mind our experience in devising a checking system for our regular line of drawings.

First we tried a printed form containing the essentials of a working drawing. This was fitted with the drawing number and checked off, after checking the drawing for each subject, as specified on the form.



ANOTHER METHOD FOR CHECKING DRAWINGS

This method answered the purpose very well but it required extra work to number, check and file these forms. In most cases the drawings contain several pieces and each piece must be considered separately, while the form in question was intended to cover the drawing as a whole.

Later I made an instrument, composed of two circular sliding disks as shown in the illustration. The subjects for which to check are printed on the under disk and read through the slot in the upper disk. After checking for one subject, revolve the slot to the next. One complete revolution of the disk finishes the piece. If the checker is interrupted, the instrument can be laid down or dropped into the pocket and will always show at what point the checking was left off; thereby preventing omissions and rechecking.

This instrument has proved very valuable to us in the way of preventing mistakes. It is easily made and with slight changes in some of the subjects would apply to any line of work.

The following is a list of the subjects printed on the under disk, that we use when checking our drawings: Design, material, cost, strength, motion, molding, assembling, clearance, dimensions, lines, views, hardening, finish, grinding, oiling, reliefs, screws, pins, No. pieces, sym. No. and dr. No.

C. P. HARRISON.

Waynesboro, Penn.

A Few Time Saving Tools

The shop with which I am connected, in the recent past developed a few tools which proved very useful in the matter of saving time.

Referring to Fig. 1, which is a sketch of a mandrel for turning locomotive rod bushings in a borer, the drawing is nearly self-explanatory, only to say that the whole mandrel is made of mild steel, *A* being case-hardened on the outside, and *B* on the inside. *B* is made of round bar cut the right length and split in the shaper in eight segments, then sweated together and finished inside and outside in the lathe. Slots *CC* are for holding

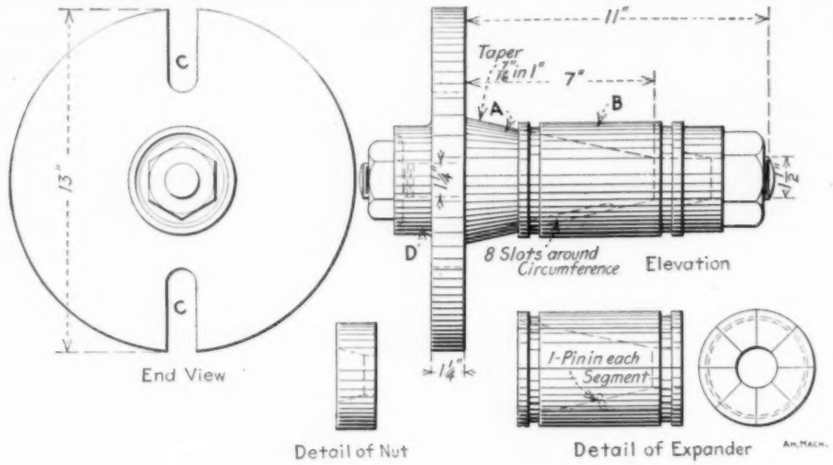


FIG. 1. MANDREL FOR TURNING ROD BUSHINGS

down the mandrel to the borer table, *D* is the projection fitting into the borer table center.

A jig for drilling locomotive driving-box wedges for the wedge bolts is shown in Fig. 2. Face *A* is placed on the bottom end of the driving-box wedge, the faces *BB* slip over the sides of the wedge, and

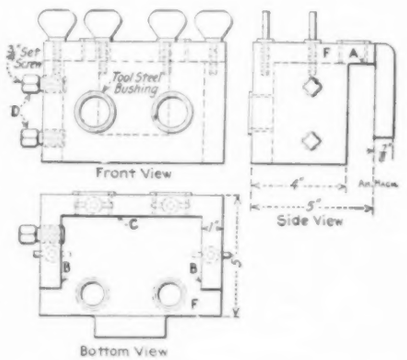


FIG. 2. JIG FOR DRILLING DRIVING-BOX WEDGES

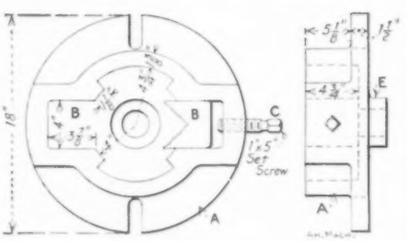


FIG. 3. CHUCK FOR BORING ROD BUSHINGS

the face *C* comes up against the back of the wedge. The setscrews *DD* are tightened, the thumb-screws loosened and the plate *F* adjusted to the center of the stock of material in the end of the wedge. The thumb-screws are then tightened and the operator is ready to drill.

The jig is made of mild steel, and case-hardened bushings are used in the holes. It saves all laying-out time and has as well the advantage that with it any man or driller can do the work.

A chuck for boring locomotive rod bushings in the borer is shown in Fig. 3. The body *A* is of mild steel and the blocks *BB* are of tool steel. The whole thing is hoisted in place, projection *E* fitting in the center of the borer table the bushing is placed in position and setscrews *C* are screwed in till the bushing is fast. Of course, a little attention must be given to centering the bushing so as not to bore it out of center.

V. T. KROPIDLOWSKI.

Winona, Minn.

Corruption and Derivation

The Latin word *ingenium,* which signifies heart, mind abilities or genius, was originally applied to any mechanical device or contrivance of an ingenious or complicated character. In the course of time, says the *Railway and Locomotive Engineer,* the word became Anglicized into engine, and those who operated mechanical appliances were called engineers. Numerous machines have taken their names from a corruption or abbreviation of the word engine, as, for instance, gin, jinny, etc., but of late years the name has been applied almost exclusively to prime movers.

"Locomotive," which is now used to denote locomotive engine, was first applied in the sense now generally used through George Stephenson naming one of his first engines "locomotion." The word was expressive and convenient and soon came into popular use. Some slight deviations from the word were common in early days. The Norris Locomotive Works, when first established, announced that it intended building "locomotors."

Report on Systems of Management

Report of the Special Committee* of the House of Representatives appointed to investigate the Taylor and other systems of shop management.

The recommendation is made that no action be taken to select a system for use in government shops.

Four conclusions are reached: Machines, tools and accessories should be standardized.

Work should be systematized and routed; machines should be grouped, furnished with proper tools and equipment; waste motion should be eliminated.

Speeds and feeds should be attained that will give the highest and best possible production.

The management should put forth every effort to incite and induce full co-operation between the working force and themselves.

*The committee consists of W. B. Wilson, of Pennsylvania, chairman; William C. Redfield, of New York, and John Q. Tilson, of Connecticut.—Editor.

Your committee, appointed under House resolution 90, adopted Aug. 21, 1911, respectfully submits the following report:

By the provisions of the resolution under which it was appointed your committee was directed—

to investigate the Taylor and other systems of shop management, which investigation shall include its applicability to Government works, its effect on the health and pay of employees, its effect on wages and labor cost, and such other matters connected therewith as may give a thorough understanding of the results of the installation of this system.

We have examined a number of witnesses relative to the various systems of shop management which have been worked out and are being introduced in a limited number of establishments throughout the country, but we have given especial attention to an investigation of the Taylor system because we found that this system is being introduced in part in two Government arsenals and its extension into other Government plants being seriously considered by the officers in charge of the Ordnance Bureau of the War Department.

All of these systems, including the Taylor system, have become known by the general term "scientific management" and are referred to as such throughout the hearings, a copy of which accompanies this report.

A great amount of good work has been done by Mr. Taylor and others in working out the details of scientific methods of shop management, but neither Mr. Taylor nor anyone else has presented to this committee a system so complete and perfect as to justify a recommendation that it be imposed in its entirety in any Government shop.

Any radical change in factory management should be a gradual evolution out of that which has preceded. The present systems, or lack of systems, with their good and their bad points are themselves the result of long evolution. No drastic or radical change in them should be suddenly or even quickly imposed by fiat from above. Men have become accustomed alike to the good and the bad that are in the systems under which they work. They know and approve the good; they know how to combat the evil. They are naturally and properly suspicious that motives purely selfish may be behind the sudden change. Confidence is a plant of slow growth. Neither the Taylor system nor any other should be imposed from above on an unwilling working force. Any system of shop management ought to be the result of mutual conference and mutual consent, and that takes time.

Government in a mill should be like government in a state— "with the consent of the governed."

It appears to your committee that no one can seriously object, and as a matter of fact no one has objected, to any system which so standardizes and systematizes the work to be performed that a greater amount of production is secured with the same expenditure of labor. Employer and employee alike and the public generally are interested in securing the largest amount and the best quality of production that can possibly be secured by the amount of labor expended. All men have a mutual interest in the accomplishment of that end. It is only when it comes to a division of that which has been produced that their interests diverge. It, therefore, follows that any system of management which has a tendency to destroy the power of employees, individually or collectively, to secure the equivalent of the production which properly belongs to them must be looked upon as being dangerous to the welfare of the community at large.

Efficiency must not be had at the cost of the men, women and children who labor and who should be the primary beneficiaries from efficiency. We should study how to produce the best results in output while also producing conditions to make the most efficient men and women to produce that output, and this must be done by conserving in every way not only their health and physical and nervous vigor, but by creating such conditions as will permit them to work out their own happiness and contentment, secure wages which will enable them to live in such a manner as to maintain their own self-respect and sufficient leisure to enjoy the refreshing influence of mental and moral recreation.

The Taylor system of shop management may be divided into three general heads: Standardization, systematization and stimulation. Efficiency may be gained in whole or in part by any of these ways, by any two of them, or by all three combined. Any or all of these devices may be carried to an extreme. In the first two devices, namely, standardization and systematization, the expense which would be created by carrying them to an extreme would act as a check against the continuance of such a condition, but that check would not exist in that portion of stimulation which is applied to the workman.

The expenses of standardization and systematization are borne by the management, while the expense of stimulation in the form of increased energy is borne by the workman. Any system of shop management which creates a burden charge through standardization or systematization which is too heavy for the shop to bear or which imposes burden charges through stimulation which are too heavy for the workman to bear should be discontinued.

That there is some loafing or soldiering among workmen has been shown by the testimony before your committee, but it is not general nor does it occur in numerous instances compared with the total number employed.

Ordinary intelligent management under any system could eliminate it entirely, or at least reduce it to the point where it would not be a serious hindrance to production. Because there are some loafers is no reason why the remainder of the workmen should either be compelled or induced to work up to the very edge of the breaking strain. There is need for production at the lowest cost, but no economic necessity can justify requiring workmen to speed up to the highest point which they can continue from day to day and from year to year, even without injury to their health and strength. To place workmen in a position of that kind is to put them in the position of a beast of burden which is required to go on from day to day performing a given task.

There is a margin between the work performed by the loafer and the maximum task for a man, and in that margin lies a proper day's work. What constitutes a reasonable day's work can only be determined by practical experience and intelligent observation. It can not be wholly determined by a stop watch or any other time-measuring instrument used only for a brief period of time. By the

stop watch you may be able to determine the time in which a piece of work can be done, but you do not thereby alone determine the length of time in which it ought to be done. The time study of the operations of any machine can be made with a resonable degree of accuracy, because all of the elements can be taken into consideration in making the computation. A machine is an inanimate thing—it has no life, no brain, no sentiment, and no place in the social order. With a workman it is different. He is a living, moving, sentient, social being; he is entitled to all the rights, privileges, opportunities, and respectful consideration given to other men. He would be less than a man if he did not resent the introduction of any system which deals with him in the same way as a beast of burden or an inanimate machine.

In making a time study of the operations of a workman, all of the elements cannot be taken into consideration, and consequently the computation cannot be made with mathematical accuracy. There is no work that can be performed, or that is performed, that is not preceded by a mental process on the part of the workman. The more skill needed in the work, the greater the mental process which precedes the expression of it. So far as your committee has been able to learn, there is no method known to scientific management by which a time study can be made of the mental process preceding the physical act.

The elements of the mental process not being susceptible of determination by a stop-watch time study, the study of itself must consequently be inaccurate and the workmen are justified in objecting to such a time study being used as a basis upon which to compute their day's work and compensation when in their judgment injustice is done them thereby.

In an effort to stimulate the workmen to increased activity various methods are used under different systems—such as discharge, fear of discharge, stop-watch time studies, and bonuses. The fear of discharge exists under any system and, no doubt, will continue to exist and to act as stimulus. The establishment of a premium or bonus presupposes the establishment of a task. The bonus system is based upon the establishment of a task large enough for an ordinary day's work and then giving additional compensation as an inducement to a workman to do more than he would ordinarily do.

The proponents of the Taylor system assert that the workman will be protected against any injustice either in the amount of work required of him or the compensation for that work by a change in the mental attitude brought about by the introduction of the system. A mental attitude which produces a spirit of cooperation between the employer and the employee is much to be desired, but such a spirit is not the result of any particular system of management, but is due almost entirely to the personality of the management and employee and the spirit that prevails in their relations to each other. Your committee is of the opinion that the mere mental attitude of the employer is too variable and unsubstantial a basis upon which to rest the material welfare of the wage worker. Standardizing and systematizing of work can be introduced successfully without any change in mental attitude from that which exists in the ordinary shop, but when it comes to introducing stimulation, a change of mental attitude by which the workman is willing to give a greater amount of energy for the same amount of pay may be very desirable to the employer of labor, but it is not always so desirable to the employee.

Standardization

The Taylor system undertakes to standardize the tools, machines, nuts, bolts, etc., so as to eliminate as far as possible the loss of time and waste energy resulting from the lack of standardization. This is "a consummation devoutly to be wished." It was shown to your committee that in the Watertown Arsenal prior to the change in system there were several kinds of gear cutters run by one man. They were of different makes, capacities and ages, and operated on different principles. It was also shown that the nuts and bolts used were not standardized and consequently much time was lost by the workman in searching for sizes for his machine. This is not good practice. The machinery should be standardized, made alike in principle, if not in size, so that the time of the workman need not be wasted over different kinds of tools in an effort to find the right one. It is an advantage to have standard hand tools in our shops, so far as possible, that the question of selecting from among many need not come up.

Similar operations on similar work can be advantageously done in a similar way. It is a great waste of effort and thought to perform one operation in one way today and in another way tomorrow. It is a still greater waste to perform one operation in three or four different ways at the same time. Where there is no standard a man never gets a chance to produce the best results, and even when he works hard he makes a comparatively poor showing. But standardizing can be carried too far. When standardization has reached the point that the cost of maintaining it is greater than the saving resulting therefrom it should be discontinued.

Systematization

Any system that eliminates unnecessary and wasted effort is good. It does not necessarily follow, however, that because any particular system has been branded as scientific that the brand alone makes it such.

Conditions vary in different shops and a system which would be effective in one might not be as effective in another. The work and responsibility of selecting, evolving, or introducing a system suitable to a particular shop must in a great measure depend upon the intelligence of the management.

The Taylor system undertakes to systematize the work first, by the establishment of a planning department; second, by detail study of the shop and the elements of a particular piece of work; third, by a routing system; and out of these grow a multitude of other details such as job cards, routing cards, time study, and many others. So much of this kind of detail work is needed under this system that it appears to your committee that constant care would have to be exercised in order to prevent the overhead charges thus created from using up all the benefits which might be derived from the proper systematization of the work.

Planning

Every well regulated industrial establishment should have a planning department proportioned to the size and need of the shop. In establishing a planning department practical common sense should be used the same as in everything else. In a small shop the manager might easily be his own planning department. In large establishments a separate department could be utilized to advantage for the proper planning of the work. In other words, every shop should be provided with the means of properly planning the handling of all work that comes to it so as to get it through the shop with the least possible waste of energy or loss of time to either men or machines.

Study of Details of Shop and Work

A detailed study of the elements of every piece of work for the purpose of discovering the best system of handling it and the elimination of unnecessary work on the part of the workman may be and no doubt is under some circumstances productive of good results. That is particularly true when unskilled men are selected to do skilled work and it becomes necessary to study their movements in order to train them to that standard of efficiency which skilled men have already attained; but it is neither as essential nor as beneficial where men are employed who are trained and skilled in the particular line of work they are expected to do. The elimination of unnecessary motion in doing any work is always a benefit, because it conserves the vitality of the workman and makes his labor more productive.

It should be the duty of every foreman to observe the methods of his workmen with a view of correcting any improper methods and removing unnecessary mo-

tion in his work. It cannot, however, be expected that every workman who has spent the greater part of his life in doing work by methods which have become familiar to him would in all instances become more efficient by the adoption of some other method even though the other method eliminated unnecessary motion. In the judgment of your committee, the determination of whether or not a detailed study of the methods of the workmen should be made would, in a great measure, depend upon the skill or lack of skill of those required to do the work.

Routing

It is always an advantage to have the work properly routed through the shop, although it is not at all times necessary that a routing card should be made out to accompany the work. In small shops the routing might be done very effectively by the oral direction of the foreman. In larger establishments routing cards are beneficial for the effective handling of the work and they are made more effective when the machines are properly arranged and grouped so that the work can pass through with as little handling as possible, but even in large shops where the same work is being duplicated day after day it would be a waste of time and an unnecessary expenditure of energy to furnish a routing card for any job after the work had reached the point where it automatically routes itself.

Stimulation

Here is the crux of the difficulty in the introduction of the Taylor or any other system of so called scientific management. So far as the workmen are concerned, they have not made any serious objections before your committee to standardizing or systematizing of the work, but they have vigorously protested against stimulation on the grounds that it tends to injure their health through overwork, and that while their wages may be temporarily increased, the result is that they are ultimately required to expend the greater amount of energy without receiving any additional pay. In the judgment of your committee the best and most effective stimulus that can be given to the work in a shop is to secure and hold a fine spirit of coöperation with the management on the part of the workmen. That cannot be secured through timing the operations of the workman with a stop watch when he considers such a procedure an indignity which recognizes him as being in the same class as a beast of burden or a machine, or when he considers such a time study inaccurate, and therefore unjust to him, or when he knows that it is to be used as a basis from which to compute the speed at which he must work and the wages he is to receive, when in his judgment the work, speed, and wage rate are being established in order to secure greater profits for the employer at the expense of the workmen. A straight piecework basis may be used as a stimulus to workmen without injury to them on work that is continuously duplicated for a prolonged period of time, provided the workmen are so situated that they can protect themselves against the entire power of the management being centered upon them individually to compel them to work beyond their normal capacity, and provided, further, that they can secure a satisfactory guaranty that when the piece rate has been once established it will not be reduced unless the methods of production are materially changed, and reduced then only in proportion to the reduction in mental and physical energy required in the production of the article.

In any form that stimulation may be used, except that of true coöperation, continuous care must be had that quality is not sacrificed to quantity.

Neither the Taylor system, the Emerson system, the Gantt system, the Brombacher system, the Stimpson system, nor any of the systems of so called scientific management have been in existence long enough for your committee to determine with accuracy their effect on the health and pay of employees and their effect on wages and labor cost. The conclusions we have arrived at are all based upon what we consider to be logical sequence of the conditions existing or proposed. The selection of any system of shop management for the various Government works must be to a great extent a matter of administration, and your committee does not deem it advisable nor expedient to make any recommendations for legislation upon the subject at this time.

Conclusions and Recommendations

We recommend, wherever possible, in Government work the machines, tools, nuts and bolts should be standardized, the management using continuous care that the cost of standardization shall not exceed the benefits to be derived from the same.

Second. That the management should at all times give studious attention to the proper systematizing and routing of work, the grouping of machines, the furnishing of proper tools and equipment, and the elimination of waste motion and waste energy on the part of the workmen.

Third. That careful study should be made of machines in order to attain the speed and feed which will secure the highest and best possible production.

Fourth. The management should put forth every effort to invite and induce full coöperation between the working force and themselves, and should, therefore, deal with the working force in the most open, frank, and candid way, affording the fullest opportunity for consultation and explanation in advance of proposed action affecting the interest of the workmen. Stop-watch time study should not be made of workmen without their consent or any conditions be imposed upon them by authority which imply any indignity; piecework may be introduced where the work to be performed is a continuous duplication, but with the express understanding that piecework rates shall not be cut unless the conditions of production are materially changed; in other cases the rate should be a straight day-wage rate at the highest prevailing rate for a similar class of work in the neighborhood where the Government work is to be performed, except that by mutual consent bonus and premium work may be introduced, but only with scrupulous care that the workman shall have full opportunity for increasing his earnings without risk of overstrain, for collective bargaining if he should so desire, and for easy and direct appeal to the management in any cases where he may think his interests threatened.

Special Work on Double Spindle Grinder

A double-spindle Besly grinder equipped for automatically burring and sizing bicycle-chain blocks is shown in Fig. 1. Fig. 2 shows the work before and after passing through this grinder. Chain blocks come to the grinder with heavy burrs from drilling operation. The grinder removes these burrs and a few thousandths of stock, leaving the chain blocks of uniform thickness within about 0.003 inch. On a second or finishing operation, the work is kept to size within 0.001 inch.

The chain blocks are fed to the grinder by gravity through a suitable tube from a hopper, placed above the machine. A toothed feeding disk, given intermittent motion through ratchet gearing, receives the work from the hopper magazine and carries it downward between two 12-in. vitrified ring grinding wheels held in ring-wheel chucks.

The grinding wheels run upward at the point where grinding takes place. When the work has passed between the grinding wheels, it drops from the toothed feeding disk, by gravity, to a trough, and is carried to a suitable receptacle.

The ratchet-feeding mechanism gives the toothed feeding disk intermittent motion, allowing it to stand still mementarily while the chain block is dropping into place from the hopper; then the feeding disk moves forward into a guide which directs the work between the grinding wheels. The central or upper part of this guide extends between the wheels, around the outer edge of the feeding disk, to keep the work from dropping out until it has passed clear of the grinding wheels.

When grinding, both spindles are rigidly locked against end movement. Springs at the outer ends of the spindles take up all end motion by drawing the spindles back against hardened and ground thrust

collars located between the spindle pulleys and the outer bearing bushings.

To compensate for slight wear on the grinding wheels, or for fine endwise adjustment, both grinder spindles together with their bearing bushings have longitudinal sliding adjustment in the grinder head castings, governed by micrometer lock-screws graduated to read to 0.001 inch. For greater changes in distance between grinding wheels, the grinder head castings may be moved and clamped on the grinder bed. Various styles and thicknesses of feeding disks may be obtained for different sizes, styles and thicknesses of chain blocks.

The ring wheels are 12 in. in diameter with 2½ in. width of grinding face. The feeding disk is so stationed that the work while grinding is passed entirely across the grinding face of the wheel and back to the outer edge, which naturally tends to keep the grinding face trued up.

The ratchet gearing is actuated by the belt pulley shown at the extreme right of the machine. This pulley drives its shaft through fiber friction collars bearing at both ends of the pulley hub, so that the pulley is free to slip on its shaft should the feeding mechanism become clogged. This construction obviates all chance of damaging the mechanism.

It is necessary that the toothed feeding disk index accurately in order to receive the next chain block to drop from the magazine. Therefore a leather-faced spring-brake engages the side of the ratchet wheel to retard its movement when struck by the ratchet pawl at high speed.

The feeding mechanism will handle the work just as fast as the hopper magazine can drop the pieces. The feeding mechanism and grinder work perfectly at a speed of four chain blocks per second, or at the rate of 15,000 pieces, 30,000 surfaces, ground per hour.

This same system of automatic grinding is applicable, as shown in Figs. 3 and 4, to many other things beside chain blocks.

A battery carbon 6½ in. long, with two parallel flats ground on one end is shown in Fig. 3. As made, these carbons are fluted cylinders. Grinding is done between two ring wheels, the same as used

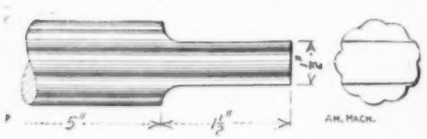


FIG. 3. BATTERY CARBON

for Fig. 1. About ½ in. of stock is removed and the grinding completed in one operation at the rate of about 1000 carbons per hour, as carbon grinds very easily. This machine is semi-automatic. The operator drops the carbon into a chucking hole in the outer edge of the slowly revolving feeding plate shown in Fig. 4.

The feeding plate is 20 in. in diameter and carries ten chucking holes, each of which has a tapered key crossing it at one edge. This key is mounted on a round plug which has longitudinal sliding movement through the feeding plate and across one side of the chucking hole. It is moved to the left by a spring operating on its right end, and to the right by a stationary cam operating on its left end.

When the tapered key is at the right extreme of its movement, it leaves the chucking hole entirely open and free to admit the work from the operator's hand. When the tapered key is at the left extreme of its movement, the tapered portion has moved into the chucking hole at one edge and engaged that side of the work, forcing the work against the opposite side of the chucking hole and effectually clamping it.

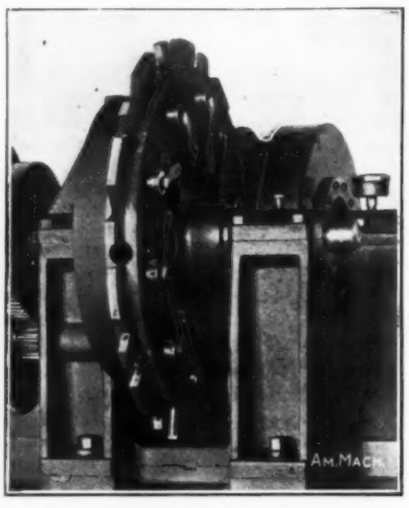


FIG. 4. THE FEEDING PLATE

Cincinnati Branch National Metal Trades Association

The annual meeting of the Cincinnati branch of the National Metal Trades Association was held on the evening of Mar. 7, at the Business Men's Club. The following officers were reëlected: Henry Ritter, president; P. O. Geier, vice-president; E. Von Wyck, treasurer; George W. Krapp, secretary; J. C. Hobart, G. M. Morris and W. J. Friedlander, members of the executive committee. William Dickson was chosen assistant secretary.

Among the speakers of the evening were: F. C. Caldwell, William Clark, Henry D. Sharp and Edwin E. Bartlett.

After the banquet a silver service was presented to J. M. Manley, who retired as assistant secretary some time ago, to become civic secretary of the Business Men's Club.

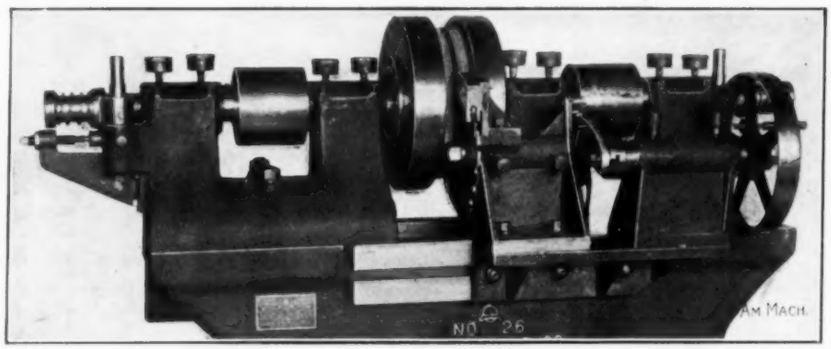


FIG. 1. AUTOMATIC DISK GRINDER

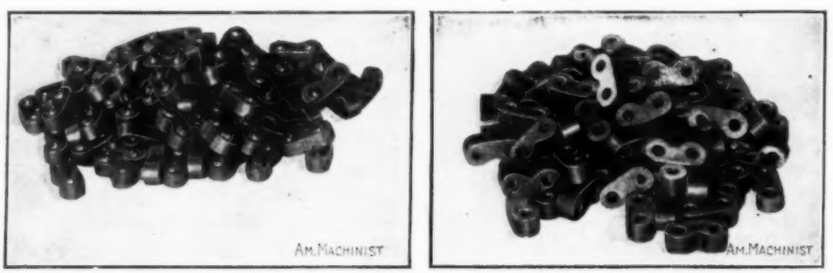


FIG. 2. THE WORK UNFINISHED AND FINISHED

The Treasury Department is taking steps to appeal a recent decision of the Board of Appraisers, in which hand shears for sheets, etc., were held to be machine tools. This is of interest in view of the widespread belief that the government officials and customs courts have a poor idea of what a machine tool is. It is hoped that the decision on the appeal will make for a better understanding.

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During 1911, 1,358,200 copies. For February, 1912 (American weekly, American monthly, English weekly and German weekly), total, 116,500.

Of this issue, 22,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 161

American Machinist

Patent Monopoly Strengthened

On Mar. 11 the Supreme Court of the United States handed down a decision strengthening the monopoly of patents. The contention is upheld that the owner of a patent can place restrictions upon the necessary supplies to be used with the patented article.

The case under review was in regard to the right of the owner of a patented rotary stencil duplicating machine to use supplies other than those manufactured by the patenting corporation. The machine was sold with a license restriction that only such supplies should be used. The Court was divided. Four associate justices concurred in the majority opinion. Three justices, Chief Justice White and Associate Justices Hughes and Lamar dissented. The majority opinion states that it is merely giving effect to fixed law.

That a patentee may effectively restrict the time, place or manner of using a patented machine, so that a prohibited use will constitute an infringement of the patent is fully conceded.

The conclusion we reach is that there is no difference in principle between a sale subject to specific restrictions of the time, place or purpose of use, and restrictions requiring a use only with other things necessary to the use of the patented article purchased from the patentee.

These limitations are merely the respect paid and the effect given to those conditions of transfer of the patented articles which the law, laid down by statute, gave the original patentee a power to impose. Whether the law on this head should be changed and the power of sale submodo should be withdrawn or limited, is not a question for a court.

The sweeping effect of this decision is weakened by the dissenting opinion of Chief Justice White. He holds serious forebodings of far-reaching evil consequences from the application of this construction, and suggests that in future cases the application be confined to the narrowest limits. He further suggests that if these evils do arise the legislative department of the Federal government should take action to amend the statute and avoid the evil.

This dissent is encouragement to those who believe that our patent monopoly is already too far reaching. There are numerous abuses that have arisen under our patent procedure. These we have frequently pointed out. Many clear thinkers believe that the present monopoly should be very much weakened and restricted. To such the present decision will appear as a step backward.

It is possible, however, that this may be but another impulse given to Congress to investigate our patent laws and procedure and to work out the much needed reforms. In any event we cannot conceive that anyone will ever attempt to enforce this restrictive license in the machine-building industry. For this we are thankful.

Manufacturing Gages at Low Cost

There is probably not a reader of the AMERICAN MACHINIST who does not appreciate the advantages of using standard gages or who is not more or less familiar with limit gages and their advantages. And yet there are comparatively few shops where gages of any kind are used as extensively as they should be either from the standpoint of accuracy or economy of production.

Even in shops where standard gages are provided for the toolroom and used as references, we are too apt to find that they are considered too expensive to be freely used and are looked upon with more or less awe—as a thing to be cared for but not actually used. True, they are often used for testing micrometers and other measuring devices, but in too many cases they are not used in the commercial sense of insuring a product that is up to their standard.

On the other hand, we find shops in which gages have been purchased long years ago and used freely, so freely in fact that they have long since ceased to be standard, and yet they are used to measure the products as before.

In a recent conversation concerning this with the works manager of a well known shop, the question of accuracy was brought up and he sent to the toolroom for the standard one-inch plug gage as a test of its accuracy. Careful measurements with several micrometers showed that this plug had been used so long that it was several thousandths of an inch small and yet this had been used as the standard inch for all parts made in the shop.

In order to be of real value, gages must be used as freely as calipers, the only obstacle in the way being the first cost of obtaining accurate gages.

In this connection, we are pleased to refer to the article by J. P. Brophy in another column of this issue, which shows the way in which the problem is being solved by his company. In addition to the gages shown he, of course, has a set of gages of unquestioned accuracy to be used as standards, but he realizes that, unless all work is accurately gaged, the fact that there are standards in the toolroom is of little consequence. Gages must be freely used if a consistent accuracy is to be maintained, and the only way to do this is to have them where they can be used as freely as calipers in the old days, and they must be of such accuracy as the work requires.

As is clearly shown, the cost of these gages need not be excessive if they are made in the manner indicated, and a personal examination of them indicates that they should answer every requirement along this line. Being case-hardened to a sufficient depth ($\frac{1}{16}$ in. being as good as a deeper hardening) makes them to all intents and purposes the equal of any other gage for everyday use. This allows the high-priced standard gages to be kept for reference only, thus preserving their accuracy for many years, and it furthermore affords a means of securing interchangeable work which is not so expensive in first cost as to be prohibitive in the average manufacturing plant.

A National Commercial Organization

President Taft, on March 1, issued a statement in which he expressed the belief that there would be great value in "some central organization in touch with the associations and chambers of commerce throughout the country, enabled to keep purely American interests closely in touch with commercial affairs."

One of the purposes of this organization would be to assist the executive and legislative branches of the government in the intelligent and impartial development of domestic and foreign trade. The need of such assistance is pointed out in these words: "It is obvious that by some means an immediate relation between the government activities and the commercial and industrial forces of our country must be established if we propose to enjoy the full advantages of our opportunity in domestic and foreign trade."

The Secretary of Commerce and Labor is instructed to take the necessary steps to initiate the formation of such an organization. To that end invitations have been sent to over one thousand commercial and industrial associations in the United States, asking them to send representatives to a conference to be held in Washington, D. C., on Apr. 15 next.

We are in sympathy with the belief that has prompted this call; such a national commercial organization will be able to aid in the important work of building up our foreign trade.

Proposed Profit Sharing Scheme by the Eastman Kodak Co.

At the annual meeting of the stockholders of the Eastman Kodak Co., to be held on Apr. 2 next, authority will be asked to put into effect a profit-sharing scheme for the firm's employees. This will be an important addition to the ranks of the firms that are thus recognizing the part workmen play in building up business success.

In working out the scheme, it has been assumed that dividends to common shareholders up to 10 per cent. are the equivalent of the employees' wages. Dividends in excess of that amount may fairly be considered as extraordinary and in justice should be shared with the employees. The plan devised, therefore, provides that the dividend to wage earners shall be based upon such extra dividends paid to shareholders.

The definite suggestion is to divide 35 per cent. of the extra dividend paid to holders of common stock among the employees in a proportion determined by the length of service and wages received. As an illustration, the extra dividend paid to the holders of common stock for the year 1911 amounted to 30 per cent. Thirty-five per cent. of this equals 10.5, which, again divided by five, the wage period in years taken into consideration in apportioning to employees, equals 2.1 per cent.

Thus an employee is to receive 2.1 per cent. of his yearly wages for each year of the preceding five-year period, if he has been employed for that length of time, or for the length of time that he has been continuously in service if less than five years. In effect, this gives each employee a little more than one week's wages for each year of continuous service up to five.

Piece-workers are to participate on the same basis as those receiving day wages or salaries. Bonuses are to be counted as wages, but payments received from the welfare fund will not be so treated.

All common-stock dividends except the dividend of Jan. 1, will be counted in the year in which they are actually paid, irrespective of the date upon which they are declared. The Jan. 1 dividend of each year will be counted in the previous year.

It is expected that the profit-sharing dividend will be paid as soon as it can be figured, probably about July 1 next.

Personals

G. Fred Bush, connected with the Honolulu Iron Works Co., Honolulu, H. I., is in this country in the interests of his country.

H. L. Ferguson, formerly superintendent, has been made general manager of the Newport News Shipbuilding Co., Newport News, Va.

Ernst Sachs, head of the firm of Fichtel & Sachs, of which the J. S. Bretz Co. are the American representatives, is in this country on a business trip.

A. L. Hopkins, until recently works manager of the Newport News Shipbuilding Co., Newport News, Va., is now vice-president in charge of the New York offices of the company.

Frank Illenberger, president of the Columbia Castings Co., Detroit, Mich., has discontinued his connection with the Colonial Steel Co., but will retain his office in the Ford Building, Detroit.

J. J. Eyre, formerly superintendent of the General Electric pattern shops, has taken an interest in the Standard Pattern Works, Rochester, N. Y. He will act in the capacity of general manager and superintendent.

Edward L. Milnor, formerly chief inspector for the Warner Gear Co., Muncie, Ind., has accepted a position with the Union Petroleum Co., mineral lard-oil department, and will look after the company's interests in the Detroit territory.

Albert G. Lea, who, for the past five years has been president of the Lea Equipment Co., New York and Philadelphia, has disposed of his interest in the above company to Philadelphia parties and has resigned as president. Mr. Lea will not enter any active business for the present.

H. R. Setz, for the past two years chief engineer of the Struthers Wells Co., Warren, Penn., has been apointed chief engineer of the Otto Gas Engine Works, Philadelphia, Penn. Mr. Setz will give his chief attention in his new position to the development of Diesel engines of the horizontal type.

A. E. Guy has accepted a position as chief engineer with the Wilson Snyder Centrifugal Pump Co., Pittsburg, Penn., organized to manufacture a new line of centrifugal pumps of Mr. Guy's design. Mr. Guy was formerly for six years chief engineer of the De Laval Steam Turbine Co., Trenton, N. J.

Irving H. Reynolds, for the past seven years vice-president and general manager of the William Tod Co., Youngstown, Ohio, will retire from that firm on May 1. Prior to his connection with the Tod company, Mr. Reynolds was for many years with the Edward P. Allis Co., now the Allis-Chalmers Company.

Charles L. Hildreth has resigned as secretary of the National Machine Tool Builders' Association, in favor of a permanent secretary, as announced last week. It is difficult to understand how he found the time apart from his regular business to devote to this work, which resulted in doubling the membership and in bringing the publications of the association to their present high standard. He retires with the full appreciation of all the members.

Information as to G. F. Weigand's present whereabouts is urgently requested in connection with a matter of great importance to him. Mr. Weigand was formerly employed by the Wheeler Condenser & Engineering Co., Carteret, N. J., as checker and draftsman. Several years ago he worked in the drafting departments of the Westinghouse Electric & Manufacturing Co., East Pittsburg, and the National Tube Co., McKeesport, Penn. He speaks German fluently and is 25 years old.

Obituary

John H. O'Donnell, president of the Waterbury Wire Die Co., Waterbury, Conn., died in that city, on Feb. 27. Mr. O'Donnell was an acknowledged authority on wire-die machinery.

Frank D. Smith, for many years connected with the Waltham Watch-Tool Co., Springfield, Mass., and well known in the machine-building industry, died at his home in that city, on Jan. 24.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

A Time Saving Automatic Drilling Machine

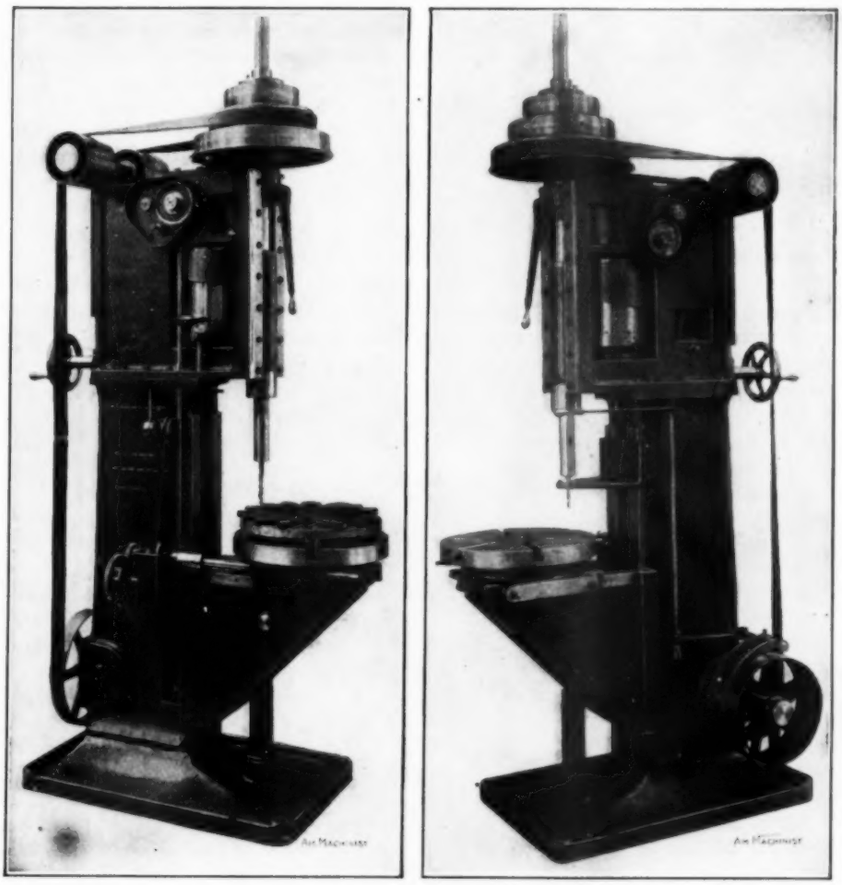
The halftone shows a new automatic drilling machine built by Baker Brothers, Toledo, Ohio.

It is a well known fact that in many cases the time occupied in actual drilling is considerably less than that required for handling the work. This machine was designed to cut this loss of time in handling to a minimum. The feed of the spindle is obtained from a cam mounted on the drum. This gives a powerful feed and quick return and also provides a dwell at the end of the stroke for facing work. When employed for this purpose work can be faced to exact depth. Correct lead can also be obtained by this means for threading.

All the running bearings of the machine are Hess-Bright ball bearings and all thrusts are taken on ball thrusts.

The spindle is large, and is carried in bronze bushed slide, which works in scraped ways.

Plain and automatic indexing tables are provided. On the plain-table machine, the operator places the work under the drilling spindle and trips the machine the same as he would a punch press. The spindle advances quickly to the work; the drill passes through the work, returns and the feed stops. The operator removes the finished piece of work, placing another in position and trips the foot lever. This enables him to handle a piece of work using both hands, thereby securing very rapid production.



TWO VIEWS OF AUTOMATIC DRILLING MACHINE

The revolving table is provided with an automatic indexing motion which at the instant the spindle is withdrawn reverses the table to the next position, bringing a new piece of work under the working tool. The period occupied by the withdrawal of the working tool and the indexing of the table is from two to three seconds. Change gears are provided so that the table may be made to index to any required number of divisions from 5 to 80.

As the table is provided with an in-and-out movement, by providing the proper change gears, it may be used to drill holes in circles with any radius within the capacity of the machine. The standard machine will drill holes in circles from 4 to 20 in. in diameter. The table is provided with a scale which shows at once the setting in regard to the diameter of the circle.

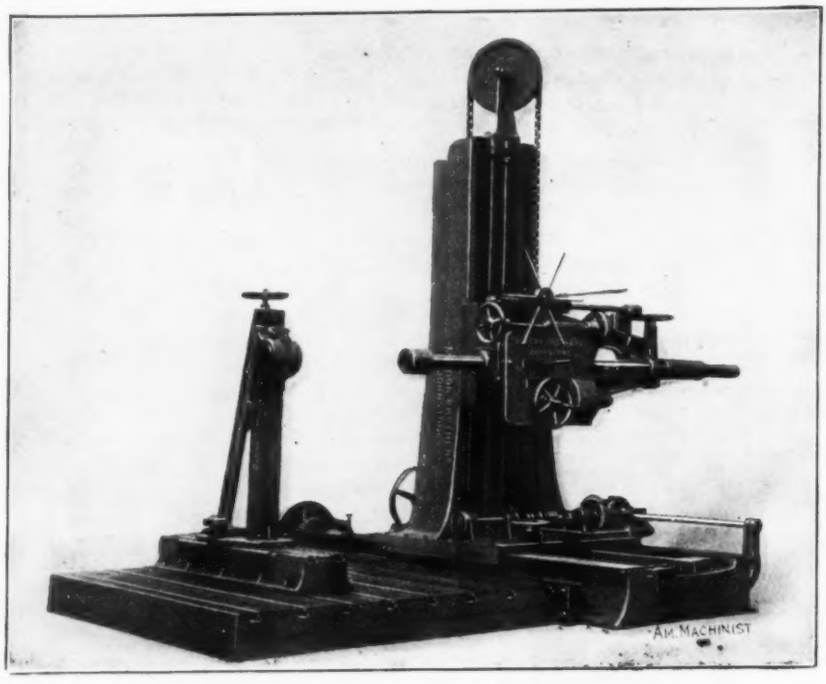
In using this machine for chuck work, from six to eight chucks are usually provided on the table, and all that the operator is required to do is to chuck and remove the work, not paying any attention to the operation of the machine other than to see that the tools are kept sharp. Should a drill break, the machine can be instantly stopped at any point. Should it be desirable, the machine can be made to index, skipping any desired number of chucks. The present rating of its capacity is a 1-in. hole in steel with high-speed drills. It has 6-in. vertical feed.

Six speeds are provided, ranging from 200 to 300 r.p.m., changes being obtained by means of a three-step cone pulley and a two-speed countershaft. Feeds are obtained by a revolving cam drum, which in combination with slip change gears give any feed desired. One cam is provided with each machine. The distance from the center of the spindle to the frame is 8 inches. The machine is equipped with an automatic indexing mechanism for any number of stops, allowing one operator to run one or more machines. It will drill to the center of an 18-inch circle. The spindle is driven by the 2-in. belt on a cone pulley, the largest step of which is 18 in. in diameter. The machine can also be arranged for motor drive if so desired.

A Horizontal Boring, Drilling and Tapping Machine

The halftone shows a horizontal boring, drilling and tapping machine, built by London Bros., Johnstone, Scotland. It is arranged to operate on a surface 90 in. long by 72 in. high. The steel spindle is 4 in. in diameter and has a self-acting feed of 48 in. The main drive is by belt to a four-stepped cone, which is back-

geared to a horizontal shaft, situated near the front way of the main bed. This shaft, through miter gears, operates the vertical driving shaft in the housing and



BORING, DRILLING AND TAPPING MACHINE

the motion is continued to the spindle by means of miter and spur gears.

All the feed and traveling gears are clearly shown in the illustration, and the operating handwheels and levers are in convenient positions. The main table is 96 in. square. The adjustable outboard support for the boring bar is placed on a separate table (not shown) when the machine is operating on work of minimum height. A circular work table is also furnished for this machine.

A Safety Lathe Dog

The illustration shows a safety lathe dog recently developed by Elmer J. Michand, Willimantic, Conn.

SAFETY LATHE DOG

It will be noted that the tail is parallel with, and in front of, the setscrew and thus affords protection from a common source of injury. In this way the tail acts as a guard for the setscrew without making the setscrew inaccessible.

An Improved Single Stroke Surface Grinder

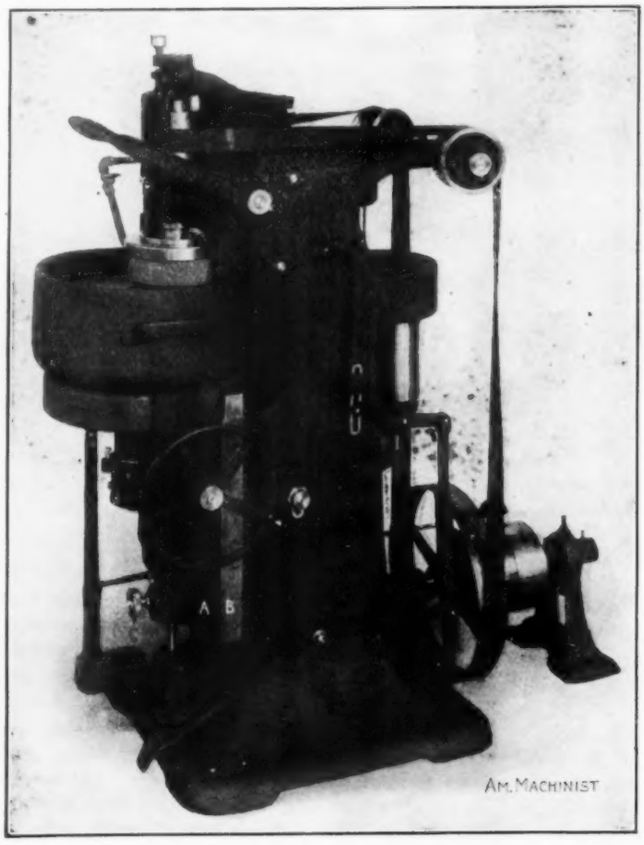
The single-stroke surface grinder shown herewith is an improved design recently developed by the Walker Grinder Co., Worcester, Mass., and is adapted for rapid grinding and finishing of small flat surfaces, especially work in the nature of rings, disks, saws, thrust collars, dies, etc.

In the main the design of the machine is similar to that shown in Vol. 33, Part 1, page 235, the essential improvement consisting of an adjustment to enable the grinding of concave surfaces.

The method employed is to tilt the work-spindle knee *A*, which has an adjustment of two degrees, and which can be instantly brought back to a level position without realigning. This is accomplished by making the knee separate from the vertical slide *B*, on the top of which is a ledge. On the extreme corners of the ledge are setscrews which provide means of accurate adjustment in one direction and form pivoting points.

The tilting movement is operated by the knurled screw *C* and the knee is held against the slide by means of four capscrews at the corners. Located quite near the capscrews are four adjusting setscrews which, although permanently set for the alignment of the knee, can be readjusted.

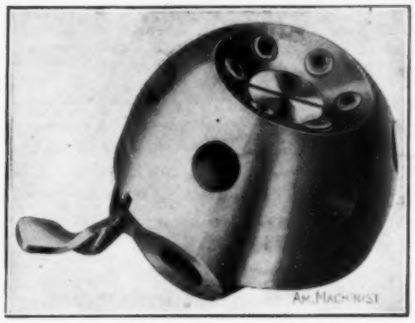
The machine is of the cup-wheel type equipped with a rotary magnetic chuck.



IMPROVED SINGLE-STROKE SURFACE GRINDER

Ball Turret Head

The ball turret head shown, made by the Milliken Machine Works, West Newton, Mass., is intended to convert the lathe into a screw machine or turret lathe.



BALL TURRET HEAD

It is put into the tailstock by means of a taper shank and can be placed at any position best suited for the operator. The upper half is actuated by releasing the lever on the side and turning by hand. Headless setscrews are used to avoid obstructions of any kind. The head is made in two sizes.

Drafting Room Apprentices

BY J. B. VARELA

From time to time, numerous suggestions concerning the best and most efficient methods of training shop apprentices have appeared in the technical press. Nothing, however, has been said regarding the training that drafting-room apprentices should receive.

Since the drafting room is a necessary adjunct to the modern manufacturing plant, the training of the men that will eventually hold the more responsible poitions as well as of those who for a time must fill the subordinate, but no less important ones, ought to receive proper care and consideration.

QUALIFICATIONS OF THE DRAFTSMEN

The successful draftsman must possess, among other qualifications, a thorough knowledge of the fundamental principles underlying the science of machine design as well as the ability to form a clear and distinct mental picture of the proposed structure that he may be called upon to design or help design.

It is the usual practice in some drafting rooms to keep the apprentices as tracers during the greater part of their apprenticeship time, and to require them to take, at their leisure, some correspondence course in mechanical drawing or mechanical engineering. The management, however, does not provide any means for the apprentices to obtain information or help in their studies. At the end of three or four years the apprentice receives a certificate stating that he has served his time, and becomes a draftsman.

The instruction papers of the correspondence schools contain many formulas and a miscellaneous collection of problems. These problems may readily be solved without any mental effort on the part of the student, by substituting the given values in the proper formula and then performing the simple arithmetical operations indicated in order to obtain the result.

This method of instruction fails at the outset because the student becomes a mere automaton, using formulas that are absolutely meaningless to him, and which he is unable to apply at all when the conditions of the problem to be solved are not coincident with the conditions set forth in the instruction paper. He consequently loses interest in his work owing to the fact that it does not give him a chance to use his reasoning power, and greatly lessens whatever confidence he may have in his ability to do the work demanded of him.

It is evident that the chief object of this method of training apprentice draftsmen is to secure an adequate supply of help for the drafting room at a very small cost, even though the efficiency of the force may be very materially diminished.

A PROPOSED SYSTEM OF INSTRUCTION

The following scheme of instruction is proposed in order to overcome the objections of such a system. Its chief aim is to give the apprentice a thorough training in the fundamental principles underlying the science of machine design, and to supplement the theoretical instruction by practical experience in the shop and in the drafting room.

Only those young men who have demonstrated their ability and fitness by a preliminary trial, should be admitted to the course. It is desirable that they have a high-school education and show their proficiency in mathematics, including plane trigonometry, the elements of physics and chemistry and last, but not least, in English, which implies correct spelling and the ability to express their thoughts in a clear and concise manner.

The apprenticeship period will last four years counting from the time the candidates have finished their preliminary trial. The apprentices will be required to work during a part of their apprenticeship time, say eighteen months, in the shops; the object being not to turn out skilled mechanics, but men having an intimate acquaintance with the shop processes and the principles involved in the construction of machinery. At the same time they would receive instruction in descriptive geometry and in the elements of analytical geometry and calculus.

Descriptive geometry will be taught as a kind of mental mechanics in order to develop the faculty of forming clear mental pictures of the problems to be solved. It also serves the purpose of acquainting the student with the fundamental theory of mechanical drawing. The elements of analytical geometry and calculus teach the student to think clearly and logically and also constitute the foundation for the technical subjects that he will subsequently study. These subjects will be taught in a practical way, keeping constantly in mind the requirements of the engineer.

When the apprentice has completed his tour through the shops he is transferred to the drafting room. His work in descriptive geometry has made him proficient in the use of drawing instruments, and he should therefore be able to start tracing and do creditable work. During the remaining thirty months of his apprenticeship, which are spent in the drafting room, he will receive instruction in the following subjects: Mechanics; the materials of construction; the mechanics of materials; and the elements of machine design.

The subject of Mechanics will comprise statics, dynamics and hydraulics. The materials of construction will give the student a fair knowledge of the properties and methods of manufacturing the materials commonly used in engineering works. The mechanics of materials will treat of the simple stresses in tension, compression and shear, combined stresses, the strength and deflection of beams, both by the analytical and the graphical methods; columns, and the phenomena of torsion. An elementary discussion of the mathematical theory of elasticity will be given in so far as it will give sufficient knowledge for studying the stresses in thick cylinders, and those induced in hoop shrinkage. The elements of machine design will deal with the theoretical calculations as well as with the practical considerations involved in the design of riveted joints, bolts, journals, bearings and lubrication, axles, shafts, gears, etc., and the elements of kinematics.

During the entire course the apprentices will be taught the value of neatness, accuracy, speed and punctuality in their work. Under no circumstances will careless or slovenly work be tolerated. The plan of study outlined above requires that the apprentices study at night, and, that from two to three hours per day five days a week be set aside for the class work.

The apprentice's usefulness increases as the work progresses and by the time he finishes the course he has become a valuable addition to the force and a man well worth keeping. It will be seen that this course gives a thorough training in fundamentals supplemented by practical experience. It will need, of course, some modifications to suit given conditions.

Testing Hacksaw Blades

By R. F. Biessmeier

How can the average machine shop best test hacksaw blades to find the most economical blade made for its use? The following deductions are the result of exhaustive comparisons and tests:

The power saw is the best device for comparing hacksaw blades in the average machine shop, because where many saw blades are used, the power saw will be found. With the power saw the conditions of the test can be made very uniform; that is, the strokes per minute, weight on saw, alignment, strain on blade and the same angularity of blade with respect to the stock cut can be uniformly determined. Furthermore, a test or comparison of saw blades can be made on a power saw with little initial cost for apparatus, or in any way interfering with the regular operation of the saw.

The power saw should be equipped with a revolution counter of some kind, so that the number of strokes per piece of stock cut can be recorded each time the stock is reset. The kind of stock of which the greatest amount is cut in the shop should be the stock selected to test the saw blades on. However, if a quick test for the cutting rate and the life of the blade is wanted, the blade should be set to work on some kind of very hard material, an unannealed tool steel of such a size that at least two teeth of the saw are in contact at all times.

The following are the data given for the test which is recorded in the given table:

Blades tested, "Power blades" 5/8x0.032 x12 in.—14 teeth to the inch; stock cut in test, 1½-in. round, Sanderson's unannealed tool steel; weight on saw blade at point of contact, 16 lb.; after 7000 strokes on single cut, saw blade was taken out; only cuts on which less than 7000 strokes were taken were counted; strokes per cut divided by 65 equals time in minutes per cut; the cost of all blades taken at 5c. each.

Name of Saw Blade	Strokes of Saw for Each Cut: First Cut	Second Cut	Third Cut	Fourth Cut	Fifth Cut	Square Inches Metal Cut Per Blade	Average Metal Cut Per Blade In Square Inches	Blade Cost In Cents Per Square Inch of Metal Cut
A 1	1005	1151	1391	2171	5926	8.835		
A 1	1084	1376	2114	4711	....	7.067		
A 1	1138	1831	4113	....	....	5.301	7.064	0.7075
B 2	1003	1097	1218	1739	....	7.067		
B 2	913	1227	2765	....	....	5.301		
B 2	1090	1481	6733	....	....	5.301	5.889	0.850
C 3	1002	1269	1871	2887	....	7.067		
C 3	910	1158	2016	6459	....	7.067		
C 3	1088	2063	....	....	....	3.534	5.889	
D 4	1155	3966	....	....	....	3.534		
D 4	910	1158	2016	6459	....	7.067	5.300	0.944
E 5	930	1813	....	....	....	3.534		
E 5	1281	....	....	....	....	1.767	2.650	1.885
F 6	1426	....	....	....	....	1.767		
F 6	1381	....	....	....	....	1.767	1.767	2.83

TABLE OF HACKSAW-BLADE TESTS

Not less than three blades of the various sizes and kinds from each maker should be tested. The blades should be of the same length, gage, width and number of teeth to the inch. The table shows the best method for recording the collected data and the working out of the final results.

The value of this table is best understood thus: "Strokes of saw for each cut;" this furnishes excellent data for comparing the cutting rate of saw blades at any stage of their life. "Average metal cut per blade;" a good comparison of capacity and durability. "Blade cost per square inch of metal cut;" a comparison on the basis of dollars and cents, the criterion.

The Spare Pulley Problem

By Miles Sampson

Anyone who has had to do with the problems of placing new, or relocating old machinery has been confronted by the spare pulley problem and the oft-repeated question, "Have we got that pulley on hand?"

It is a question of availability, and can be answered only by a quick and accurate knowledge of the details: How many, what diameter, face, bore, etc. Almost every manufacturing establishment has scores of used pulleys of all sizes and descriptions stored in out-of-the-way corners.

To make these pulleys available is the problem.

One large concern has solved the problem in a very simple way, using the card illustrated, which measures 3x5 in.

The man in charge of pulleys, or, in a smaller shop, the foreman millwright, is responsible for the system and takes care of the small amount of clerical work in connection with it. A pulley, on going into storage, is carefully measured by him, and recorded on the form, by filling in dimensions, or crossing out where necessary. An arbitrary number is given to the pulley and inscribed on the back of the card. Two cards are filled out exactly alike; one is retained and the other is sent, for filing, to the drafting room or engineering department, where all plans and orders for placing machinery originate. Their file is then, at all times a complete record of pulleys on hand.

On reversing the operation the card of the pulley required is selected from the catalog, its number is specified on the shop order and the card goes through the shop office to the person in charge of pulleys. Both cards are destroyed by him when the pulley is delivered for use, and all chance for duplication is thus avoided.

WOOD RIM PULLEY.....Diam.
....x....Rim.....Hole....x....Hub.
....Bushing....x....Spline....x....Key.
Crown or Flat. Split or Whole.
One or two Spiders Lagging.....
Remarks on Age, Pattern, and General Condition.....
.....
Stored in.....
Reported By.....Date.....

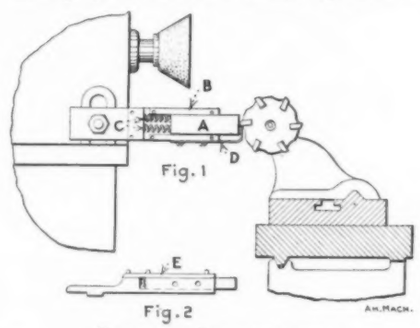
This system has proved its worth in the daily routine, in many rush orders, and in certainty of results and economy of time and stock, well merits the attention of the engineer.

Oilstone Attachment for Tool Grinder

By F. J. Hohnhorst

The diagram is of an oilstone attachment which certainly puts a smooth, keen edge on reamers, rose bits, etc. This attachment works especially fine on spiral-fluted reamers.

Everyone knows the disadvantage of trying to stone a spiral-fluted reamer by hand. The cutting edge of a reamer having spiral flutes and stoned by hand is always more or less rounded and has hollow places rubbed in it. When this attachment is applied it is stoned under the same conditions as when it is ground, thereby obtaining a perfectly straight and keen cutting edge.



Oilstone Attachment

After the clearance has been properly ground on the reamer, the oilstone attachment is bolted beneath the wheel on the emery-wheel head of the tool grinder, and the stone is brought against the tooth of the reamer until there is a light tension of the springs, then proceed with the operation as when the reamer was being cleared.

The casing *B* consists of ¾x1½-in. cold-rolled steel 7 in. long, with a square slot shaped in it to receive the oilstone *A*, then the two springs *C* and lid *E* are placed in proper position as shown in Fig. 1. *D* is the finger-rest support for the tooth of the reamer and can be used for a straight or spiral-fluted reamer. *E* is made of 1½x⅛-in. cold-rolled steel. Fig. 2 shows the attachment assembled and ready for use.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

W. L. Morrison & Co., Boston, Mass., have been awarded the general contract for the new reinforced factory at Cambridge, Mass., for the Berkshire Motors Co. The building is being erected in accordance with plans and specifications of Monks & Johnson, architects and engineers, 7 Water St., Boston, Mass. The plans call for a three-story reinforced-concrete manufacturing building, 239x50 ft., with provision for two additional stories and a boiler house, 29x24 ft. Estimated cost, $50,000 to $55,000.

The Stevens-Duryea Co., Chicopee, Mass., will erect several new buildings in connection with the automobile shop at East Springfield, Mass. The first will be a four-story brick building, 80x500 ft., containing elevators. The company is experimenting on metal automobile bodies. The F. W. Dean Corporation, Exchange Building, Boston, Mass., is the architect.

The Champion Horseshoe Co., Pawtucket, R. I., has been formed and will locate a plant in that city for the manufacture of horseshoes.

The plant of A. & E. Henckels, on Connecticut Ave., Bridgeport, Conn., will be enlarged. An addition of brick and Ohio sandstone, 66x188 ft., two and one-half stories high, will be erected. Samuel M. Green, Inc., Springfield, Mass., are the architects in charge of the work.

The contract has been awarded for the construction of a two-story garage, 26x30 ft., for E. N. Blanke, Greenwich, Conn. Noted Feb. 29.

The New Britain Machine Co., manufacturer of engines and wood-working machinery, has had plans prepared for a four-story factory building, 160 ft. long. Three stories will also be added to the one-story building constructed last year.

The William Schollhorn Co., manufacturer of pliers and nippers, New Haven, Conn., will make extensions to its plant.

The Shoe Hardware Co., manufacturer of buckles, etc., Waterbury, Conn., is erecting a five-story brick factory, 86x96 ft.

James H. Davis and Homer H. Judd, Bristol, Conn., will erect a garage on Riverside Ave.

MIDDLE ATLANTIC STATES

The Jamestown Street Ry. Co. is considering plans for addition to its repair shops and car barns, at Jamestown, N. Y. A. W. Olson is chief engineer.

A garage, 199x253 ft., will be erected by the Central Building Improvement & Investment Co., 149 Church St., New York, N. Y. W. E. Thompson, 1123 Broadway, New York, is architect. Estimated cost, $50,000.

The Worden-Allen Co., 2 Rector St., New York, N. Y., has recently started the construction of repair shops for the New York Central R.R., at West Albany, N. Y. The estimated cost is $300,000. Noted Mar. 7.

The Tremont Iron Works, 1334 Stebbins Ave., Borough The Bronx, New York, N. Y., will erect a factory on Stebbins Ave., near Freeman St., Borough The Bronx. William Schmanfer is architect.

Luke Killgallon will erect a one-story garage 50x100 ft., at Far Rockaway, N. Y. Estimated cost, $5000. Howard & Callman are the architects.

The Globe Malleable Iron & Steel Co., Syracuse, N. Y., whose plant was burned Jan. 23, has begun the reconstruction of the works. The new plant and the equipment will cost about $100,000. There will be a main building and buildings for pattern making and store and boiler houses. The main building will be 540x106 ft.

The carriage manufacturing plant of Anthony J. Grad, 718 Broadway, Buffalo, N. Y., was damaged by fire, Mar. 3. Loss, $25,000, covered by insurance.

The Pratt & Letchworth Co., of Black Rock, near Buffalo, N. Y., is erecting a small addition to its iron foundry.

The General Electric Co., Schenectady, N. Y., contemplate extensive alterations and additions to their plant in the near future.

The Proctor Transmission & Appliance Co. will move its plant from Springfield, Mass., to Fulton, N. Y., and will occupy a portion of the plant of the Hunter Arms Co. The concern manufactures a transmission and clutch for automobiles.

The Orchard Machinery Manufacturing Co., successor to the Gasport Motor Co., Gasport, N. Y., is about to commence operations in the manufacture of power sprayers and gasoline traction engines.

The Evans Manufacturing Co., which is rebuilding its plant, at Hammond, N. Y., for the manufacture of farming implements, recently destroyed by fire, will require new equipment of lathes, bolt-threading machines, drill presses, etc.

The John Brown Sons Co., Olean, N. Y., will erect a factory, at Olean, for the manufacture of razors.

The Victor Talking Machine Co., Camden, N. J., will construct a five-story, 72x172-ft. factory, at Second and Cooper Sts. Ballinger & Perrot, 1211 Arch St., Philadelphia, Penn., is architect.

W. K. Grone, 166 Park Ave., Orange, N. J., will erect a garage, to cost $7000. A. T. Remick, 103 Park Ave., New York, is the architect.

Bids are being received by A. H. Thompson, architect, 222 Market St., Newark, N. J., for the erection of a two-story garage and loft building for Mahlon S. Drake, Forest Hills, N. J. Estimated cost, $10,000.

The Oxweld Acetylene Co. will construct a factory, at 646 Frelinghuysen Ave., Newark, N. J. It will be of reinforced concrete, three stories high, 75x240 ft., and will cost $80,000. Frederick Phelps, 15 Clinton St., is architect.

The Safety Car Heating & Lighting Co., Jersey City, N. J., has awarded a contract for the erection of a factory, at Twelfth St., Jersey City, 100x100 ft., five stories high, of brick and concrete construction.

The Bergdoll Machine Co., Philadelphia, Penn., is considering establishing a branch plant, probably at Trenton, N. J., for the manufacture of motors and transmission, of a special design.

Fire damaged the Manchester Automobile Garage, Fayette and Charter Sts., Pittsburg, Penn., Mar. 12. Loss, $50,000.

The Pittsburg Rys. Co., Pittsburg, Penn., will expend approximately $467,563 for car shops and machinery. J. D. Callery, Sixth Ave., Pittsburg, is president.

Bids are asked on the following dates by the Paymaster-General, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for supplies: At 10 a.m., Apr. 9, Schedule 4408, Class 41, six pneumatic motor, wire-rope hoists, capacity three tons each, to be delivered at the Mare Island navy yard, Vallejo, Calif., within 60 days from receipt of order; at 10 a.m., Apr. 16, Schedule 4405, Class 141, one gas-producing apparatus, to be delivered at the Navy Yard, Puget Sound, Bremerton, Wash.; Schedule 4419, Class 142, one automatic screw-driving machine, No. 4, motor driven, with all necessary parts to drive both flat-head and round-head screws, sizes Nos. 8, 9, 10, 11, 12, 13, 14, 15 and 16, to be delivered at the navy yard, Philadelphia, Penn.

Plans are being prepared for the erection of a one-story garage, 60x95 ft., for C. T. Miller, Webster and Gibson Aves., Scranton, Penn.

The Baltimore & Ohio R.R., Baltimore, Md., will enlarge the railroad shops, construct a new roundhouse and turntable and install new machinery, at Garrett, Ind. A. W. Thompson, Baltimore, is general manager.

John S. Bridges, 26 South Charles St., Baltimore, Md., will erect a two-story garage, 22x33 ft., to cost $5000. E. L. Palmer, Jr., 908 Roland Ave., Baltimore, is architect.

The Virginia Railway Co., Norfolk, Va., will erect a 10-stall extension to its roundhouse, a 100-ft. addition to its machine shop and a 12-stall stripping shop.

SOUTHERN STATES

The Gibbs Machinery Co., Columbia, S. C., manufacturer of engines and machinery, has commissioned J. B. Urquhart, Columbia, to prepare plans for the construction of a new plant, at Assembly, Blossom, Gates and Wheat Sts. Noted Jan. 18.

The foundry and machine shop which was owned by Cliff Williams, at Meridian, Miss., was destroyed by fire, on Mar. 5. The loss is $100,000.

Bids are being asked for a 5-ton electric traveling crane for foundry use by the Chattanooga Roofing & Foundry Co., Chattanooga, Tenn. Noted Mar. 7.

It is reported that the Louisville & Nashville R.R. is planning the construction of new shops, at Winchester, Ky. C. F. Giles, Louisville, Ky., is superintending machinist.

MIDDLE WEST

Robert L. White, Cleveland, Ohio, will erect a garage. Harry A. Cone, 1228 Schofield Building, Cleveland, is architect.

F. Baird, architect, Bangor Building, Cleveland, Ohio, is receiving bids for the erection of a 1½-story garage, 70x70 ft., for John A. Zangerle, 7101 Detroit Ave., Cleveland.

The Grant Lees Machinery Co., Cleveland, Ohio, will erect a new factory.

The Erie R.R. will build yards and repair shops, at Randall, Ohio, during the summer. A. G. Trumbull, Cleveland, Ohio, is superintending mechanic.

The Economy Tool & Specialty Co., Cleveland, Ohio, will buy some new machine tools. H. J. Owens is president.

The Porcupine Water Heater Co., Cleveland, Ohio, makers of water heaters, will equip a new factory.

The Otis Steel Co., 3131 Lakeside Ave., Cleveland, Ohio, makers of steel plates and castings, will erect three blast furnaces, two pig-casting machines, 12 open-hearth furnaces, a blooming mill and machine shops. Noted Mar. 7.

The Typewriter Specialty Manufacturing Co., Steubenville, Ohio, will buy light manufacturing machinery. F. H. Converse is mananger.

Specifications have been issued by the Purchasing Department of the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co., Cincinnati, Ohio, for new tools for the Beech Grove shops.

The Clyde Cutlery Co., Clyde, Ohio, is in the market for a special wood-shaping machine for knife handles.

The Norwood Machine Co., Norwood, Ohio, will erect a one-story garage and machine shop, 60x120 ft. Estimated cost, $8000. Hunt & Reiter, First National Bank Building, Norwood, are the architects.

The Empire Automobile Co. has been incorporated, with a capital of $100,000, to manufacture the new "Empire 25." This firm has taken over the plant of the Empire Motor Car Co., of Indianapolis, Ind. The incorporators are C. E. Gibson and Charles B. Sommers, of Indianapolis; A. Waldheim and David Sommers, of St. Louis, Mo., and David May, of Cincinnati, Ohio.

Bertsch & Co., Cambridge City, Ind., have announced plans for the construction of new machine shops, to cost $100,000. Construction will start this spring.

The Suburban Motor Car Co., Detroit, Mich., will erect a new factory for the manufacture of motor cars. William H. Laukin, Bad Axe, Mich., is president.

The Winkley Manufacturing Co., 866 Warren Ave., Detroit, Mich., manufacturer of brass goods, will erect a one-story addition to its plant.

The Hygeia Filter Co., Detroit, Mich., manufacturer of water filters, will erect a new factory.

The K-R-I-T Motor Co., Leib and Wight Sts., Detroit, Mich., will construct and equip several new buildings for the manufacture of motor cars.

The Timken Detroit Axle Co., 132 Clark Ave., Detroit, Mich., is having plans prepared for a four-story factory, 60x140 ft., estimated to cost $70,000. Nettleton & Weaver, Penobscot Building, are architects.

The Otto Young Estate, Chicago, Ill., will erect a one-story garage, 52x172 ft., to cost $12,000. J. C. Llewellyn, 38 South Dearborn St., Chicago, is the architect.

Bids for the erection of a one-story garage, 110x156 ft., are being received by C. Kleinfelder, 6558 Sheridan Road, Chicago, Ill., the owner. H. J. Liedberg, 154 West Randolph St., Chicago, is the architect.

William Ohlhaber, architect, 1519 Park St., Chicago, Ill., is preparing plans for the construction of a new factory for the William Ganschow Co., manufacturer of engineers' and machinists' special machinery, 1001 Washington Boulevard. It will be five stories high, 80x125 ft.

The Wheeling Corrugating Co., manufacturer of sheet metal, 168 North Clinton St., Chicago, Ill., is having plans prepared for a two-story factory, 126x206 ft. Paul Gerhardt, 64 West Randolph St., is architect.

Plans have been completed by E. E. Roberts, architect, La Grange, Ill., for the erection of a two-story garage, 36x66 ft., for L. P. Yale.

Schipper & Block, 122 South Adams St., Peoria, Ill., will erect a one-story and basement garage, to cost $10,000. Hewitt & Emerson, 321 Main St., Peoria, are the architects.

E. R. Thayer, Springfield, Ill., will erect a one-story garage, to cost $9000. G. B. Helmle, Springfield, is the architect.

Crane & Barkhausen, architects, 53 University Building, Milwaukee, Wis., have been commissioned by the Rundle-Spence Co., manufacturer of plumbers' and steamfitters' supplies, to prepare plans for remodeling the Manegold mill building, Water and Fowler Sts., into a light manufacturing building. Cost, $17,000.

The Harley-Davidson Motor Co., 3800 Chestnut St., Milwaukee, Wis., has awarded a contract for the construction of an automobile shop, at Thirty-seventh and Chestnut Sts., to cost $125,000. It will be of reinforced concrete, five stories high. Noted Feb. 8.

The Standard Aluminum Co., Two Rivers, Wis., has increased its capital stock from $50,000 to $100,000, and is in the market for a list of machinery for its new building, in course of construction. W. S. Bremer is manager.

WEST OF THE MISSISSIPPI

The New Hampton Manufacturing Co., New Hampton, Iowa, manufacturer of gas engines, will remove its plant to Sioux City. A factory 50x100 ft. is being erected there.

The American Dartium Steel Casting Co., Kansas City, Mo., is considering plans for the construction of a plant at Seventeenth St. and Crookston Ave. Two buildings, one 50x90 ft., and the other 90x150 ft., will be erected. Steel castings and tool steel will be manufactured.

The Southern Pacific Co. will construct a round-house at Beaumont, Tex., to replace the one destroyed by fire several years ago.

The McEwen Bros. Manufacturing Co., Oklahoma, manufacturer of drilling and pumping machinery, will erect a factory 220x100 ft., at Tulsa, Okla. J. H. McEwen is interested.

WESTERN STATES

The Winton Motor Car Co., Spokane, Wash., is considering the erection of a building for its business. H. G. Bowman is the local manager.

Joseph Paquett, 112 East Twelfth St., Portland, Ore., will build a two-story garage, 100x100 ft.

J. H. Shaffer, Planada, Calif., will erect a garage on Santa Fé Drive. The building will be 60x100 ft.

U. B. Mayer, F. G. Gross and F. A. Cleveland will start a factory in Corcoran, Calif., for the production of galvanized-iron ware. The building and machinery will cost $25,000.

P. B. McClure and R. E. Moore, Carpinteria, Calif., are contemplating the erection of a commercial garage and repair plant on Main St., Saticoy, Calif.

Robert Howland, Los Angeles, Calif., will soon commence the erection of a commercial garage and machine shop.

The H. O. Harrison Co., Los Angeles, Calif., will soon commence the erection of a commercial garage and repair plant on Olive St., Los Angeles.

The Greer-Robbins Co., Los Angeles, Calif., will soon commence the erection of a commercial garage and repair plant, on Twelfth and Flower Sts., Los Angeles. Modern machinery will be installed.

The Standard Oil Co., San Francisco, Calif., has taken out a permit to erect a garage for the care and repair of its commercial cars.

George F. Bell, San Francisco, Calif., will build a plant for the manufacture of pumps.

William Cutler, Sawtelle, Calif., will soon erect a plant at Sawtelle, for the manufacture of his patented rotary vacuum and compression pump.

The Victor Combination Kitchen Boiler Co., Oakland, Calif., will erect a plant for the manufacture of its specialties at El Segundo, Calif. The plant will be fully equipped. Joseph Antonucio is the principal owner.

C. W. Valiant, Santa Monica, Calif., is having plans prepared for a commercial garage and repair plant, to be erected on Marine and Main Sts. Estimated cost, $15,000.

GENERAL MANUFACTURING

NEW ENGLAND

The plant of the D. B. L. Granite Co., East Barre, Vt., was destroyed by fire, Mar. 2. Loss, $12,000.

Crocker, Burbank & Co., Fitchburg, Mass., will build a 100x80-ft. addition to their No. 7 paper mill, two stories high, of mill construction. Alvah Crocker, treasurer, has charge of the work.

The contract for a brick addition to the paper mill of the New York & New England Co., on Ely St., Holyoke, Mass., has been awarded. It will be 20x26 ft., two stories high.

The Mishawm Knitting Co., New Bedford, Mass., will erect a new factory and a dye house.

A 2,500,000-gal. high-duty pumping engine will be installed in the water-works plant at North Attleboro, Mass., and the building will be reconstructed and made fireproof. William Plattner, North Attleboro, is Engr.

Plans are being prepared for the erection of a new mill for the Silesia Worsted Co., North Chelmsford, Mass. Noted Mar. 7.

The Wallingford Co., manufacturer of novelties and silver-plated ware, Wallingford, Conn., is having plans prepared for the construction of a new brick factory, four stories high, 35x156 ft.

MIDDLE ATLANTIC STATES

The Vanity Manufacturing Co., Washington St., Buffalo, N. Y., has taken over the Leather Veneer Co., manufacturer of shoe polish, and will continue in the manufacture of black, tan and white shoe polish.

The Patterson Shoe Co. has taken over the Patterson Co. Infants' shoes and sandals will be made in quarters in the Beecher Building, Buffalo, N. Y.

The International Auto League & Tire Co. has broken ground for its new factory building to be located on Northland Ave., Buffalo, N. Y. The building in which auto tires will be manufactured will be of two stories, 100x150 ft.

A water-works system to cost $140,000 will be installed at Mount Morris, N. Y. J. Aubrey Striher is village secretary.

Hoch & Wagner are preparing plans for the erection of a four-story factory at Flatbush Ave. and Livingstone St., Borough of Brooklyn, New York, N. Y., to be occupied by the Bradbury Piano Co.

Bids will be received until 10:30 a.m., Mar. 25, by Joseph Johnson, fire commissioner, 157 East Sixty-seventh St., Borough of Manhattan, New York, N. Y., for furnishing and delivering packing tools, materials, etc., for the marine division.

The Buffalo Sled Co., North Tonawanda, N. Y., has awarded the contract for constructing its new factory. The structure will be of brick and concrete, three stories high, 65x300 ft.

The Visar Knitting Co., manufacturer of sweaters, etc., at Niagara Falls, N. Y., has acquired additional property and will immediately erect a two-story concrete addition to its plant, 50x50 ft.

The plant formerly occupied by the Ivory Button Co., at Seneca Falls, N. Y., has been leased and will be operated by the Eagle Button Co., Newark, N. J.

The Smith Carpet Co., Yonkers, N. Y., is planning to erect an addition to its Coquette carpet mill.

The city of Oneida, N. Y., is considering the installation of a water-softening plant. Estimated cost, $25,000.

Plans for the construction of a municipal water-works system at Wolcott, N. Y., are being prepared by C. C. Hopkins, consulting engineer, Cutler Building, Rochester, N. Y. Estimated cost, $35,000.

The Monroe Canning Co. has been organized, at Brockport, N. Y., and will erect a plant on part of the property of the Brockport Coal & Cooperage Co.

The Minetto-Meriden Co., Minetto, N. Y., will reconstruct its boiler house, at a cost of $25,000.

The city of Sodus, N. Y., is considering the installation of a municipal water-works system.

The Quaint Art Furniture Co., 1809 Park St., Syracuse, N. Y., is considering plans for the construction of a three-story, 100x300 ft., factory. C. J. Litchinson is secretary.

The wall-paper factory of David Schutz, 757-759-761 Passyunk Ave., Philadelphia, Penn., was damaged by fire, Mar. 6. Loss, $30,000.

Binder Bros., Emaus, Penn., will erect a large shoe factory on North St., between Fifth and Sixth Aves.

A planing mill will be erected by the Mohton Planing Mill Co., Mohton, Penn. The company is capitalized at $10,000. The incorporators are William E. Fisher, John W. Spangyer and John B. Stevens.

The Galen Mountain Co., Galen Hall, Atlantic City, N. J., will erect a new power house, 50x72 ft., at Wernersville, Penn.

The Vermillion Sugar Co. has purchased thirty acres of land at Abbeville, Penn., and will soon begin the construction of a sugar-refining plant.

Plans are being prepared by Carl P. Berger, architect, 1416 South Penn Square, Philadelphia, Penn., for the construction of an eight-story factory, 36x80 ft., for C. F. Rumpp & Son, manufacturers of leather novelties, Ninth and Cherry Sts. The estimated cost is $30,000.

The Penn Tobacco Co., Wilkes-Barre, Penn., will construct a factory, four stories high, 150x150 ft. P. P. Lewis, Coal Exchange Building, is architect.

The Fawn Realty Co., Baltimore, Md., will erect a large wood-working factory on Falls Ave. One 125-hp. boiler, and a 75-hp. engine will be installed.

SOUTHERN STATES

The Franklin Cotton Mills, textile manufacturers, Concord, N. C., have awarded a contract for the construction of a brick factory, three stories high, 100x200 ft.

The Franklin Cotton Mill, Concord, N. C., will erect a three-story addition 100x200 ft., to its mills.

The Durham Hosiery Mills, Durham, N. C., will erect an addition and install new machinery to double the capacity of its plant.

The Union Development Co., J. W. Adams, president, Chattanooga, Tenn., will construct a hydro-electric power plant of 50,000-hp. capacity, to cost $400,000, near Asheville, N. C.

The F. R. Penn Tobacco Co., Reepsville, N. C., has had plans prepared by Francisco & Jacobus, consulting engineers, 200 Fifth Ave., New York, for the construction of a new factory, three stories high, 80x150 ft. The estimated cost is $50,000.

The Glenwood Cotton Mills are considering plans for the construction of a new mill, at Easley, S. C. It will be 105x342 ft., and will cost $400,000.

The Savannah Electric Co. will build a new power plant, on the river. It will have a capacity of 11,000 kw., and will cost $1,000,000. F. M. Yanger is chief engineer.

The McIntosh Mills, Newnan, Ga., will spend $40,000 in equipping their plant with new machinery.

A company, composed of Henry Merkle, Macon, Ga., and J. W. Plin, of Chicago, has been formed in Macon, Ga., to build and operate a bread factory. The plant will be built at Plum, New and Cotton Aves. The company is capitalized at $25,000.

Bids will be received by the Trustees of City Bonds, Titusville, Fla., until noon, May 20, for constructing a water-works system, to include a pumping station, elevated reservoir, water mains and fire hydrants. G. M. Robbins is chairman.

The plant of the Southern Sewer Pipe Co., Birmingham, Ala., is undergoing extensive improvements and will be entirely remodeled. The latest clay-working machinery will be installed.

Boag, Ala., has voted to construct an electric-light plant. W. H. Bartlett is mayor.

The oil mill of the Okolona Oil Co., Okolona, Miss., was destroyed by fire, Mar. 1. Loss, $60,000.

The plant of the Gulf Refining Co., Meridian, Miss., oil refiners, was destroyed by fire, Mar. 2. Loss, $60,000.

W. S. Milne, of Cleveland, Tenn., has purchased 47 acres of land in Chattanooga, Tenn., on which he will erect a $100,000 chair factory.

The Stone Huling Co., Bristol, Tenn., will erect a lumber plant. It will be of brick, three stories high, 200x150 ft.

MIDDLE WEST

Bids are wanted for transformers for the new $2,000,000 lighting plant, at Cleveland, Ohio. W. J. Springborn is Director of Public Service.

The City of Cleveland, Ohio, will buy power-plant equipment for a new West Side water tunnel. Mr. Schultz is superintendent.

Contracts have been awarded for the erection of a woodworking plant, to be built for the Aetna Realty Co., Cleveland, Ohio. The cost will be $12,000.

The plant of the Union Paper & Twine Co., Cleveland, Ohio, was destroyed by fire on Mar. 10.

The J. B. Felber Motion Picture Machine Co., Cleveland, Ohio, will buy new machine-shop tools for a new factory. J. B. Felber is superintendent.

The Cleveland Cooperage Co., Cleveland, Ohio, maker of barrels and tubs, will make large additions to its present plant.

The Independent Brewing Co., Massillon, Ohio, just organized, with $200,000 capital, will build and fully equip a large modern brewery.

The Davies Manufacturing Co., Detroit, Mich., recently incorporated, with a capital of $150,000, will manufacture airless automobile tires in a plant to be erected at Alliance, Ohio.

The Merchants Ice Manufacturing Co., Toledo, Ohio, will build a large ice-making plant and will buy power and refrigeration machinery. O. F. Robbe is manager.

The Cascade Steam Laundry Co., Cincinnati, Ohio, is in the market for laundry machinery.

Fire destroyed the plant of the Summit Rubber Co., at Barberton, Ohio. Loss, $10,000.

The Pennsylvania R.R. has awarded a contract for the construction of a one-story planing mill and pattern shop, 82x204 ft., to be erected in Columbus, Ohio. The estimated cost is $60,000. W. C. Cushing, Pittsburg, Penn., is chief engineer.

The plant of the Edwards Printing Co., general printers and publishers, Youngstown, Ohio, was partially destroyed by fire, on Mar. 10.

The Alvey-Ferguson Co., Oakley, Ohio, manufacturers of conveying machinery, have commissioned the Allyn Engineering Co., Cincinnati, Ohio, to prepare plans for a new power plant. Two new 150-hp. boilers will be installed.

The Western Reserve Furniture Co., Warren, Ohio, has increased its capital from $50,000 to $90,000, and will purchase new woodworking machinery.

The St. Mary's Brick Co., St. Mary's, Ohio, will be in the market for power equipment. G. Boesel is manager.

The plant of the Central Glass House, Utica, Ohio, was damaged by fire, Mar. 2. Loss, $40,000, partly covered by insurance.

The plant of the cut-glass factory of the Pitkin & Brooks Co., Bowling Green, Ohio, was destroyed by fire, Mar. 10. Loss, $15,000, partly covered by insurance.

Witmer & Brown, consulting engineers, Chapin Block, Buffalo, N. Y., are preparing plans for reconstructing the municipal water-works system, at Portsmouth, Ohio. The cost is estimated at $300,000.

The City Council of South Bend, Ind., will soon ask bids for installing two 5,000,000-gal. pumps in the water-works plant. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are consulting engineers.

Plans have been prepared for a 5,000,000-gal. pumping station and a water-works plant to be installed at Benton Harbor, Mich.

Bids will soon be asked for installing two auxiliary pumps at the east side water-works plant, Saginaw, Mich. R. F. Johnson is superintendent of water-works.

The city of Kalamazoo, Mich., will spend $140,000 in enlarging its municipal lighting plant, and an additional sum of $175,000 will be provided for extensions provided amendment can be secured to the charter to permit the city to sell power for commercial purposes.

Bids will be received by the Fire and Water Committee of Canton, Ill., until 2 p.m., Mar. 30, for erecting at Ayenue D pumping station a pumping engine of the Meyer valve-gear, high-duty, flywheel type. C. W. Snyder is chairman.

The plant of the Illinois Woolen & Cotton Manufacturing Co., 902-904 South Morgan St., Chicago, Ill., was damaged by fire, Mar. 7. Loss, $75,000.

Two buildings of the Diamond Glue Co., Robinson St., Chicago, Ill., were destroyed by fire. Loss, $10,000.

The United States Silica Sand Co., Ottawa, Ill., has purchased a tract of land in Ottawa, and will erect a large sand-refining plant.

The Chicago Oyster Pail Co., 504 South Greene St., Chicago, Ill., has had plans prepared for the construction of a new factory at Ogden and Washtenau Aves. It will be 124x200 ft., of brick and stone, and is estimated to cost $125,000. Frank O. DeMoney, 144 La Salle St., is architect.

Plans have been completed by M. F. Strauch, architect, 1431 Diversey Boulevard, Chicago, Ill., for the construction of a two-story, 48x125-ft. factory, for F. Vogel & Sons, manufacturers of stamping and embroidery, 1253 Columbia Ave. The estimated cost is $12,000.

The Northern Wisconsin Canning Co. has had plans completed for the erection and operation of a pea-canning factory, at Cumberland, Wis.

The Fort Atkinson Canning Co., Fort Atkinson, Wis., has decided to erect a new three-story, fireproof factory, and equip it with machinery. J. A. Hageman is president.

The Milwaukee Lace Paper Co., 285 South Water St., Milwaukee, Wis., will construct a factory, at Holton and Lee Sts. It will be 82x137 ft., five stories high, of reinforced concrete, and is estimated to cost $75,000. Herman J. Esser, Camp Building, is architect.

WEST OF THE MISSISSIPPI

The Acme Roofing Tile Co., Des Moines, Iowa, will construct a plant near Camp Douglas, in the spring. George Winters, of Mason City, president.

H. J. Heinz Co., Muscatine, Iowa, will expend about $10,000 in improvements to its canning factory. Wm. Lesher will superintend the work.

The Brunswick - Balk - Collender Co., manufacturer of sporting goods, is building a factory in Dubuque, Iowa.

Ziegler Bros., Muscatine, Iowa, plan the erection of a $100,000 canning factory, at Grand Junction, Iowa.

The plant of the Blackduck Cooperage Co., Blackduck, Minn., was damaged by fire, Mar. 2. Loss, $2000.

The Kansas City Packing Box Co., Kansas City, Kan., will construct a new plant to cost $250,000. R. E. Lee Wilson, Memphis, Tenn., is president.

The Kansas Flour Mills Co. plans to build a 1000-bbl. flour mill in Wichita, Kan. The cost is estimated at $200,000. A. J. Hunt is secretary.

The contract for constructing a water plant at Gunnison, Colo., has been awarded to the Central Colorado Construction Co., Colorado Springs, at $67,500.

The packing plant of the Montana Packing Co., Butte, Mont., was burned recently with a loss of $50,000.

The American Carbon & Battery Co., East St. Louis, Mo., whose $10,000 plant was recently destroyed by fire, has let a contract for the erection of a steel and concrete building.

Fire damaged the upholstering department of the Pullman repair shops, 513 South Twenty-first St., St. Louis, Mo., Mar. 9. Loss, $5000.

N. Warenskiold, Dallas, Tex., is preparing plans for improvements to the water-works system at Waco, Tex., estimated to cost $400,000. A 5,000,000-gal. filter plant, two 5,000,000-gal. high-duty pumps, and two 5,000,000-gal. centrifugal low-lift pumps will be installed. S. J. Quay is superintendent of water-works.

Bids will be received by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., until 3 p.m., Apr. 17, for the mechanical equipment, exclusive of gas piping and lighting fixtures of the United States post office at McKinney, Tex.

The Southwestern Utahnite Safety Powder Co. will erect a plant of two-ton daily capacity at or near El Paso, Tex. Later the company will erect similar plants at different points in Texas, Oklahoma, New Mexico and Arizona.

The Magnolia Cotton Oil Co., Houston, Tex., whose plant was recently destroyed by fire, will construct a fireproof refinery with daily capacity of 700 barrels.

WESTERN STATES

The Amalgamated Sugar Co., Ogden, Utah, plans the erection of a beet-sugar factory, at Burley, Idaho. The building will be 66x500 ft. Le Roy Eccles, Ogden, Utah, is general superintendent.

The city of Woodland, Wash., plans for the installation of a water-works.

The C. H. Libby Co., Seattle, Wash., is having plans drawn for a six-story concrete flour mill. Bebb & Wendell are the architects. The cost is estimated at $400,000.

Improvements to the plant of the New England Fish Co., at Ketchikan, Tacoma, Wash., to the amount of about $1,000,000 will be made this season. The cold-storage and freezing plant completed last season at a cost of $250,000 is to be enlarged to three times its present capacity. A. L. Hager is vice-president and manager of the concern, whose head office is in Boston, Mass.

Bids are being received at the office of the Standard Oil Co., Bellingham, Wash., for the construction of a distributing plant. There will be five large tanks, the largest of which will have a capacity of 10,000 barrels.

The Chas. H. Lilly Co., of Seattle, Wash., will build a flour mill of 1000 barrels daily on its Harbor Island property.

The city of Klamath Falls, Ore., is contemplating the installation of a water system to cost about $135,000.

G. M. Miller, Joaquin Miller and James Miller, Eugene, Ore., have acquired a water site near Florence, Ore., and are planning for the erection of a hydro-electric power station.

The Acme Cement & Plaster Co., Gypsum, Ore., will erect a new factory. It will be of steel, three stories high, 50x288 ft. The estimated cost is $200,000.

The Brighton Mills Co., Nehalem, Ore., will construct a new plant.

The Pratt Lowe Preserving Co., Santa Clara, Calif., is considering plans for the construction of a two-story cannery, 100x350 ft., to cost $19,000.

The Troy Laundry Co., Fourteenth and Main Sts., Los Angeles, will build an addition to its plant. It will be of brick and reinforced concrete, and is estimated to cost $25,000. W. J. Saunders, Wright & Callender Building, Los Angeles, is architect. Noted Jan. 11.

The contract for furnishing the mechanical equipment for pumping station No. 2, at Fort Mason, San Francisco, Calif., has been awarded to Charles C. Moore & Co., 99 First St., San Francisco, at $140,000.

The city of Santa Ana, Calif., will soon commence the construction of an auxiliary water system.

Bids will be received by G. W. Hallman, city clerk, Orange, Calif., until 5 p.m., Mar. 22, for one horizontal cross compound Corliss valve, high-duty crank and flywheel pumping engine, having a capacity of 1400 gal. per minute.

The Resoleum Products Co., Redlands, Calif., is planning for the erection of a new manufacturing plant at Riverside, Calif. The company manufactures citrus by products.

The city of Ventura, Calif., is planning for the erection and operation of a municipal lighting plant. The city trustees are in charge.

George D. Selby, Portsmouth, Ohio, contemplates the erection of a plant for the manufacture of shoes, at Anaheim, Calif.

The Northern California Power Co., San Francisco, Calif., is planning for the installation of new equipment in the local substation at Chico, Calif. Improvements will also be made in the lighting system.

The Los Angeles China Co., Los Angeles, Calif., is planning for the erection of a new manufacturing plant at Glendale, Calif. The plant is estimated to cost $25,000.

The Alaska Packers Association, Alameda, Calif., is preparing to expend more than $1,000,000 in enlarging and improving its plant on the estuary off the north end of Sherman St. The additions will include warehouses, shipping buildings, shops for the manufacture of cans in which salmon is packed, wharves, subharbors and railroad tracks. Also facilities for unloading and storing cargoes of salmon brought down from Alaska will be installed.

Farrar & Thorn, Escondido, Calif., a large cement-contracting firm, are contemplating the erection of a plant at Dinuba, Calif., for the manufacture of cement pipe and cement building blocks.

CANADA

The British Canadian Canners, Ltd., Hamilton, Ont., will erect canneries, factories and warehouses, at Cobourg, Bowmanville, Port Robinson, Merlin and Highgate, Ont. Munro & Mead, Chancery Chambers, Hamilton, are architects.

The Saskatchewan Flour Mills Co. has awarded a contract for constructing a flour mill, at Moose Jaw, Sask.

Plans are being prepared by the Dominion Canners' Association for a modern canning plant, which it will build at Ridgeway, Ont., on a site which has been secured. W. H. Schott, Waterford, is superintendent.

The Sunlight Soap Co., Calgary, Alta., is considering plans for the construction of a new factory this spring.

FOREIGN

An electric-light and power station is about to be constructed by the government of Southern Nigeria, at Kiva Falls. It is also planned to extend electric lighting and power supply in Lagos.

A steamer with a capacity for seven to ten persons and 2000 pieces of wood, draft not to exceed 50 centimeters, and able to tow a 30-ton barge against a current of 4 kilometers per hour, at a speed of 10 to 12 kilometers per hour, is required by the Colony Neuva Germania, Paraguay.

Two suction gas engines of 100 and 300 hp. respectively, one refrigerating machine of 150 tons capacity, and the necessary freezing and cold-storage accommodations will be required to increase the equipment of the abattoirs and refrigerating plants at Corio, which the Geelong Harbor Trust Commissioners of Australia are planning. Buildings and machinery for the canning of meat will also be required.

Tenders, closing Apr. 18, are invited by the Public Works Department, of Brazil, for work at the harbor of Paranagua, at an estimated cost of 4,731,724 milreis. Specifications may be had upon application to the Office National du Commerce Exterieur, 3 Rue Feydeau, Paris.

It is reported that several new branch lines will be constructed by the Vladikavkaz Ry., at an estimated cost of about $27,000,000. The scheme also includes harbor works at Azov, Rostrov and Novorossisk.

A water supply is being contemplated for Tangier and Casablanca for which the Committee of Public Works of Morocco will invite tenders on completion of the specifications. It is estimated that the work will cost between $300,000 and $400,000.

The Pioneer Mill Co., Honolulu, H. I., will erect a new mill with steel building and crane. Cost estimated between $40,000 and $50,000.

New Incorporations

METAL WORKING

The Automatic Co., Portland, Maine, has been incorporated with a capital of $250,000 to manufacture automatic vending machines. R. H. Burton, Somerville, Mass., is president.

The Auto Foto Co., Boston, Maine, has been incorporated with a capital of $100,000 to manufacture mechanical photographing machines. The incorporators are P. B. Amnudon, Cambridge, and K. H. Dainren, Maynard.

The Standard Engineering Works Co., Woonsocket, R. I., has been incorporated with a capital of $100,000 to manufacture machinery. The incorporators are L. W. Campbell, G. F. Roussean, Woonsocket, and A. A. Jenckes, Pawtucket.

The Springfield Alberta Co., Hartford, Conn., has been incorporated with a capital of $70,000 to manufacture machines and tools. The incorporators are C. L. Spencer, Suffield; S. C. Dunham, H. L. Stearns and W. N. Thompson, Hartford.

The Swiss Magneto Co., Buffalo, N. Y., has been incorporated with a capital of $250,000 to manufacture magnetos and ignition apparatus. The incorporators are H. S. Martin, Dunkirk; B. H. Phillips and E. C. Schlenker, Buffalo.

The Laco Phillips Co., New York, N. Y., has been incorporated with a capital of $300,000 to manufacture electrical supplies. The incorporators are P. H. Noyes, C. C. Stetson, New York, and R. S. Strack, Brooklyn.

The G. L. Fox Co., Albany, N. Y., has been incorporated with a capital of $50,000 to manufacture patented articles. The incorporators are G. L. Fox, E. W. Rieck and J. Morrison, Albany.

Forthcoming Meetings

National Metal Trades Association. Fourteenth annual convention, Apr. 11, Hotel Astor, New York City. Robert Wuest, commissioner, New England Building, Cleveland, Ohio.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1, Hotel Hollender, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

DRAFTSMEN on design, detail and tool work; also pattern makers familiar with automobile work. Apply factory office, The Pope Manufacturing Co., Hartford, Conn.

A MAN experienced in cold-rolling spring steel ⅛ in. down to .003 in., and drawing spring wire; must know what equipment is necessary and how to install same. Address P. O. Box 941, New Haven, Conn.

Maryland

SHIPYARD FOREMAN on steel hulls. Address Box 74, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

SUPERINTENDENT for an established manufacturing plant making fine tools in New England; must be superior experienced American mechanic, tool maker and designer; capable of managing 200 skilled machinists; salary, $2000 to $4000; buildings, equipment, power, costs, etc., are handled by the manager. Box 81, Am. Machinist.

Michigan

CHIEF DRAFTSMAN—Wanted at once by one of the oldest and largest manufacturers of high-grade motor cars; must be a man with considerable automobile experience who can command and maintain the respect of all with whom he comes in contact; must have sufficient executive ability to enable him to handle a large force and turn out the work in a thorough and systematic manner, with rapidity without sacrificing neatness and accuracy. Box 87, Am. Machinist.

Minnesota

ORDER CLERK—A railway manufacturing company offers position to experienced man about 30 years of age as order clerk; man must understand railway-shop work, be able to order from blueprints, must be familiar with shop accounting and be able to systematize his work; position would be permanent and pays a good salary; applications will

not be considered unless applicant states clearly just where he has worked, for what length of time, and just what experience in this kind of work he has had. Box 82, Am. Machinist.

Missouri

DIE MAKERS, first-class; do not apply unless you are familiar with our line of work and capable of earning the highest wages. Dalton Adding Machine Co., Poplar Bluff, Mo.

DRAFTSMAN and tool designers, thoroughly familiar with adding machines and typewriters; only experienced men need apply. Dalton Adding Machine Co., Poplar Bluff, Mo.

New Jersey

DESIGNER on tools and machinery for small interchangeable parts. Box 73, Am. Machinist.

New York

TEACHER of forging in a New York City high school; compensation begins at $5 a day, five days a week; must have high school diploma and five years' practical experience in the trade. Box 88, Am. Machinist.

SALESMAN—An importer of ball bearings requires the services of a salesman for territory west of New York; must have technical training, selling experience, and good references; permanent and growing position for a man who can make good. Box 94, Am. Machinist.

SUPERINTENDENT for woodworking machinery shop, to be started in live western New York city; must be familiar with construction of light woodworking machinery, not over 40, a hustler; knowledge of designing advisable; must invest $3000; will draw good salary and participate in profits; proposition backed by business men of means and repute, and will bear critical investigation; give experience and references. Box 80, Am. Machinist.

Ohio

JIG AND DIE MAKERS; first-class, on small, accurate, interchangeable parts. Box 85, Am. Machinist.

MECHANICAL DRAFTSMAN, with experience on machine-tool work. Cleveland Automatic Machine Co., Cleveland, O.

MANAGER for machine shop, thoroughly familiar with Corliss pumping machinery and air compressors; must be a mechanical engineer, technical graduate, with both selling and shop experience; give reference, state age, experience and salary required. Box 8, Am. Machinist.

TRAVELING ENGINEER for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

INSPECTOR, at once, by Ohio manufacturer; man experienced in automatic engines of the single and four-valve types to act as inspector, and if necessary, foreman of machine work and erection; replies must give full particulars of experience, salary desired, etc., and will be treated strictly confidential. Box 70, Am. Machinist.

MECHANICAL DRAFTSMAN, at once, by Ohio manufacturer, who has had automatic-engine experience and who is thoroughly familiar with strength of materials and automatic engines of the single and four-valve types; replies must give full details of experience and salary desired and will be treated strictly confidential. Box 69, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

FOREMAN for shop, capable of handling general repairs on pumps, engines, electrical machinery and general class of work found in coal and coke plants; write fully age, nationality and references. Box 66, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

POSITIONS WANTED

Michigan

FOREMAN, machine shop, wants position; first-class all-around mechanic; can keep the quality of work up to standard and handle men to advantage. Box 97, Am. Machinist.

New Jersey

MECHANICAL DRAFTSMAN, practical mechanic, wishes position office or factory; location immaterial. Box 90, Am. Machinist.

FOREMAN, practical mechanic, wide executive experience, machine tools, machinery, jigs, fixtures, etc., wants responsible position. Box 91, Am. Machinist.

MECHANICAL and electrical engineer, age 34; technical graduate; 13 years' experience in shop, designing, installation and operation of power and industrial plants, general engineering and manufacturing; competent to economically design, manufacture and superintend output of engineering product. Box 93, Am. Machinist.

New York

DRAFTSMAN wishes position; technically educated; three years' experience. Box 100, Am. Machinist.

MECHANICAL SUPERINTENDENT, expert mechanic, engineer, wants to make good connection; moderate salary. Box 95, Am. Machinist.

GENERAL SUPERINTENDENT and manager of large successful concern desires change; nine years in present position. Box 10, Am. Machinist.

CHIEF DRAFTSMAN or designer, experienced man, wants position on general or automatic machinery; technical education; good references. Box 99, Am. Machinist.

MECHANICAL ENGINEER wants responsible position; executive ability and shop training; large experience as designer and salesman of machine tools. Box 84, Am. Machinist.

FOREMAN—A molder with wide experience in job work and machinery castings desires position as foreman; would prefer a small shop on contract basis; high-grade references. Box 96, Am. Mach.

FOREMAN, tool room; a thorough, first-class man, particularly on dies, with uptodate ideas and capable of making his own drawings; now employed as such, wishes to make a change. Box 65, Am. Machinist.

GERMAN MECHANIC and constructor, with 25 years' experience in making apparatus, clocks, tools and small machinery, like to start a little modern model and experimental shop in New York; desires connection with a single concern about experimental or other precise work in this line. Box 78, Am. Machinist.

SUPERINTENDENT, designer; a married man, 33 years of age, a thorough mechanic, experienced as machinist, draftsman and executive on machine tools, electrical, hydraulic, automatic, experimental, transmission, elevator machinery and tool work; especially successful as production superintendent with a large eastern corporation where keen competition has made low cost and improved product imperative; a position is wanted with a growing concern where ability and push will have its legitimate results. Box 98, Am. Machinist.

ADVERTISING MANAGER, with 12 years' experience of mechanical and engineering products, wishes to make a change; one who knows how to write trade literature and the right sort of advertising copy that brings inquiries; one who is a thorough systematist and is successful in planning and executing advertising campaigns; one who has had a wide experience in the use of trade papers and knows the merits of every one in the mechanical field; I thoroughly understand all details pertaining to designing, engraving, printing and paper buying; I can demonstrate my ability to produce absolutely distinctive results. Box 83, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

TOOL DESIGNER, college graduate, 10 years' shop and office experience, automatics, special machines, jigs, desires change; best references. Box 89, Am. Machinist.

Pennsylvania

SALESMAN—Young man, 30 years of age, now manager of business in Philadelphia, desires to make change and associate with firm requiring the services of a shrewd salesman, close buyer, of executive ability and technical training. Box 86, Am. Machinist.

Rhode Island

FACTORY ENGINEER, machine and tool designer, demonstrator, speed boss, rate setter, have time studies tabulated; can tune up your plant. Box 60, Am. Ma.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 950 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

For Sale—Gasoline engine, 2 hp.; write immediately; snap. The Emporium, Fort Wayne, Ind.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Designs and investigations undertaken in mechanical engineering. Address Box 92, Am. Machinist.

For Rent—Two-story brick factory, 7500 sq.ft., Plainfield, N. J. A. J. Brunson, Plainfield, N. J.

Removal—On Mar. 1 we moved to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

For Sale—Friction pulley and universal grinding attachments patent for sale; also Canada patent outright. For full particulars address R. Rosner, Madison, Wis.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

For Sale—A prosperous machine metal working and tool plant; equipment complete, including wood-pattern department; excellent location in N. Y. City and a going business; will require about $15,000; will deal with principals only; excellent reason for selling. Earl A. Bowman, 416 Broadway, N. Y. City.

Machinists—Do you want to earn a day's pay during the noon hour? We are offering big inducements to hustlers in every machine shop in the country; a bonafide business proposition; no triflers need apply; write for particulars. Alert Tool Co., 221-223 N. 23rd St., Philadelphia, Penn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Drawings, specifications, estimates and manufacture of jigs, fixtures, automatic machinery, special equipments, punches and dies by a corps of experts; write us your requirements for suggestion of ideas and cost estimates. Laurin & Sundstrom, 271 Hicks St., Brooklyn, N. Y.

Talks With Our Readers

By The Sales Manager

After the discussion I had with Walter Gaines about the use he made of the advertising pages, I got in the habit of dropping in on him, as I passed through the shops, in a corner of which he had his office, and asking him questions about different things connected with the operation of the plant. I found him a mine of information.

One day, while looking for a folio containing the rough plans of a new shop which had been talked of a couple of years back but not built, he took out a number of things from the large bottom drawer of his desk to get at the papers underneath. On the top of the heap was a home-made pasteboard binder labeled "NEW SHOP."

"Here," said I, "this is what you're looking for."

"No, it isn't," he replied; "look inside and you'll see."

Accordingly, I opened the binder and found it filled with sheets of manila paper to which were attached advertisements and articles, clipped principally from the AMERICAN MACHINIST. All of them pertained to shop construction, equipment or operation, and they were preceded by an index, on one or two lines of which the ink was almost fresh.

"Hello," I ejaculated, as the meaning of it dawned on me; "this is where you were going to surprise us again, is it?"

"Yes," he admitted, with a grin, "I'm about up to the minute on the subject of new shops; and yesterday, when you telephoned that our appropriation for the new building was certain to go through this time, I looked all through that folder to freshen up on what it contained. The plans I know by heart, so I didn't need to refer to them."

"The advertisements you have clipped here seem to cover about everything conceivable that's needed in a shop," I remarked, as I turned the pages. "I don't suppose it will take you long to go over these with the Superintendent and Purchasing Agent, and we can get our preliminary inquiries right out!"

"No, it's all there," he replied. "We'll be able to make up our list without any delay."

"There are a good many things here," I said, as I continued to turn the pages, "that I never knew of before."

"Nor did I," he answered, "until I came to collect the stuff. I thought I was pretty well posted on shop equipment and just who made it; but I found we had a choice of it far above and beyond what anyone would suppose. Then there's a good deal that I knew about but never paid much attention to until I saw the force of some of the advertisements. For example, there's those new high-speed hydraulic forging presses. It's a cinch that we're going to have one of them for the new shop if I have any influence. I'll bet this little collection will save us a good many thousands of dollars in first cost and operating expense, and there won't be so many come-backs from users of our machinery from broken shafts, etc., as we have had with our old equipment."

"Have you kept on getting these clippings together, even when the plans were called off?" I queried.

"Sure thing," he affirmed. "I knew we'd have to come to it sooner or later. Why, the breakages during the past two years that we've had to make good would have paid a good share of the cost of the plant; and look at the new business we've lost on account of them.

"It wasn't any time to lay down on this work; so I just kept on the lookout for new ads. and articles and put 'em in the folder."

Since this conversation the new shop has been built and put in operation; and, when I was there the other day, the general manager couldn't say enough in praise of it.

"That man Gaines," he said, "is certainly a wonder when it comes to picking out equipment. I don't know where he gets all his information, as he doesn't see much of other plants."

Then I told him about the binder full of clippings.

"That's enterprise," he remarked. "It makes me think more of Gaines than ever. I knew he read advertisements pretty carefully, and we depend on him to do so; but I didn't realize that he made such systematic use of them."

A Modern Colorado Machine Shop

By Fred H. Colvin

Some of the special machines and devices used in building the Leyner rock drill.

A powerful hydraulic broacher of novel design, an unusual lapper; automatic milling on a gear cutter; the use of band saws on metal; a hardening room with furnaces of concrete, and other interesting features.

One of the most modern machine shops in the West is that of the George Leyner Machine Co., at Littleton, Colo., which is about 10 miles south of Denver. Here a very modern plant has been erected with ample opportunity for expansion as necessity arises. The main shop has a gallery where the lighter machines are placed and the smaller work is done. As in nearly all of the shops in and around Denver, the bulk of the work is connected with mining; rock drills and similar machines being the main product of the Leyner company.

A Large Pneumatic Broacher

A very interesting broacher, entirely different from the type usually found, is shown in Fig. 1. This is a vertical machine, operated by compressed air, which bears on a piston of large area in the cylinder supported by the three uprights. The action of the cylinder is controlled by a valve, which controls the passage of oil, regulating it at will, and preventing all surging action due to the elasticity of the air. It makes a very satisfactory machine and is very conveniently operated.

Many different kinds of work are broached in this shop, some of them being shown on the floor at the lower left-hand corner. The piece to be broached is laid on the supporting collar at the top of the upright in the center, the point of the broach entered in the work and the ram brought down by admitting air pressure through the cylinder above.

The speed of the ram can be varied, depending, of course, on the size and shape of the piece being broached. The broach is not fastened in the ram, but is simply forced through by it and dropped through the work onto a cushion, which prevents injury to the end of the broach. This is easily removed through a side opening in the central support, and placed on a tray, ready to be used on the next piece.

Drilling Awkward Pieces

Some of the parts used in making rock drills which are an awkward shape to handle and require holes to be drilled at various angles, are shown in Figs. 3 and 4. Fig. 3 shows one of the fixtures being used for drilling a comparatively easy hole at right angles to the large bore of the piece.

For this operation the piece is held in the horizontal slide, which can readily be seen in the illustration. It is then slipped into the vertical slide, while the holes on the upper end are drilled, after which it is transferred to the fixture shown in Fig. 4 for drilling some of the angular holes. These are very simple but very efficient features, and have reduced the drilling time even more than might be imagined.

In this connection it is also well to call

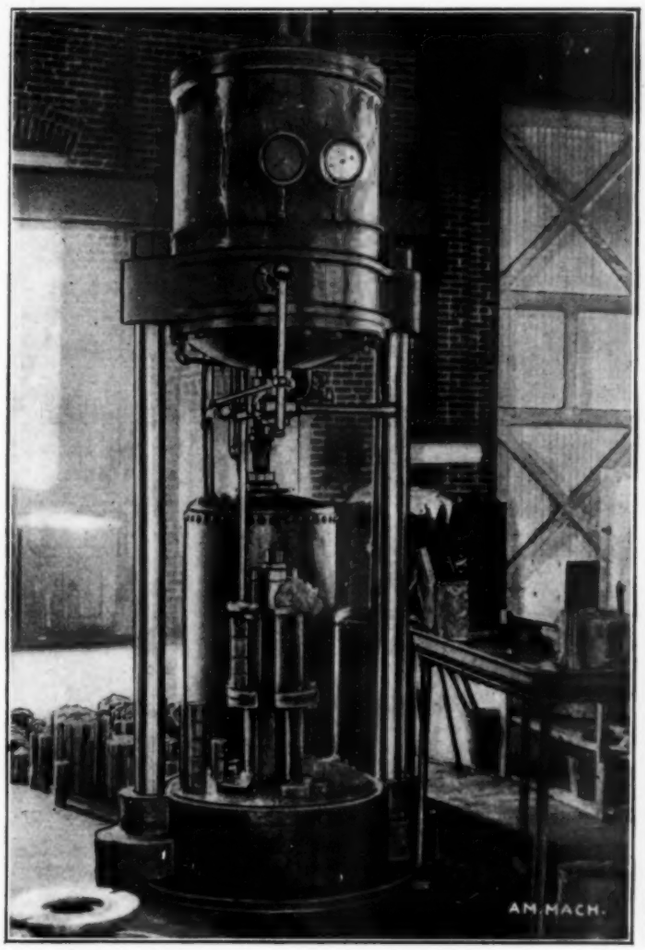


Fig. 1. A Large Hydro-pneumatic Broacher

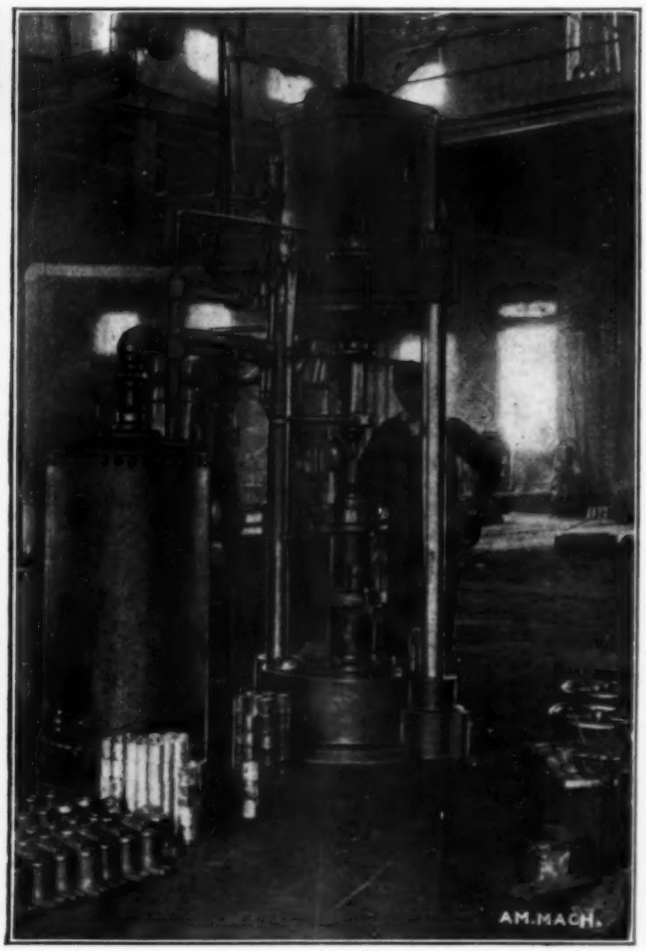


Fig. 2. As It Looks from Behind

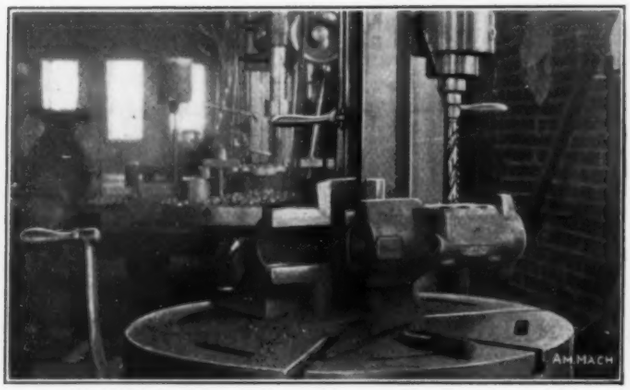


FIG. 3. CONVENIENT DRILL FIXTURE

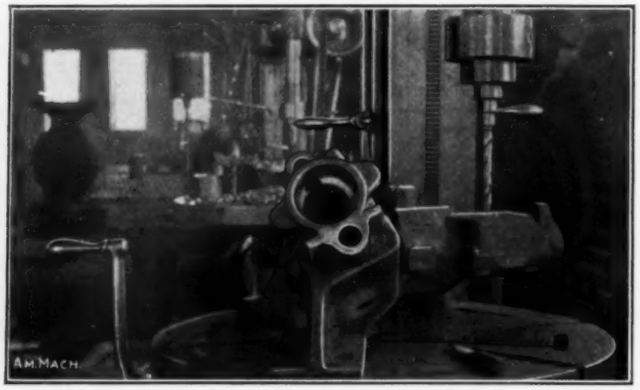


FIG. 4. DRILLING ANGULAR HOLES

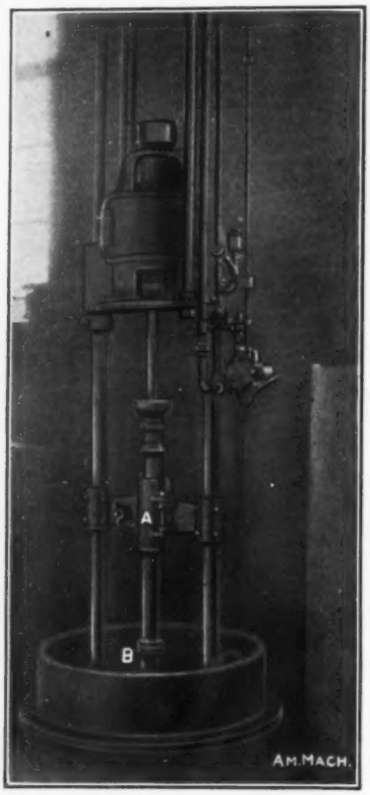


FIG. 5. THE POWER LAPPER

attention to the extension sleeve, which has been fitted to the crank handle for clamping the table in its supporting arm. This enables the table to be easily loosened or clamped by one movement of the hand, and without reaching up underneath the table and feeling for the proper location of the wrench.

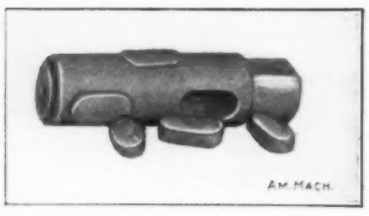


FIG. 6. ONE OF THE LAPS

A LARGE LAPPER

After the rock-drill cylinders have been bored out, they are finished by lapping by a special power lapper, designed and built by the Leyner company for its own use. This consists principally of two vertical rods or uprights, which carry both the work-supporting device and the lapping head, so that they can be adjusted to almost any position with relation to each other. The work to be lapped is clamped in place at *A*, Fig. 5, by the swinging covers or lids, and the motor-driven lapping head is brought down so that the

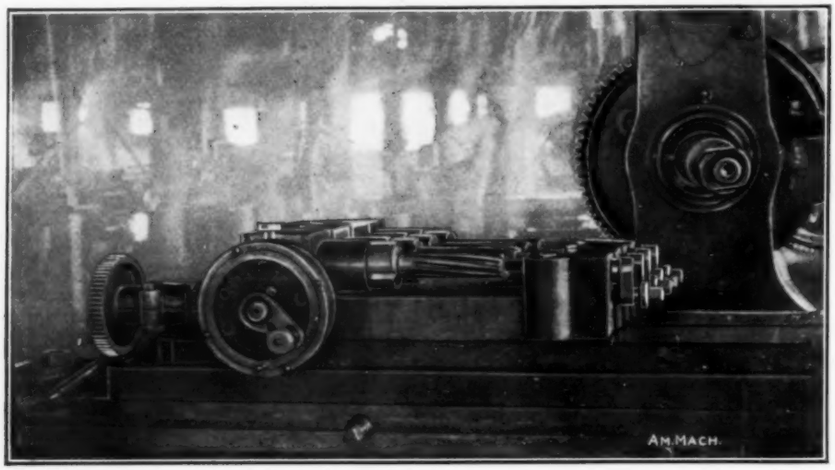


FIG. 7. MILLING FOUR SPIRAL FLUTES AT ONCE

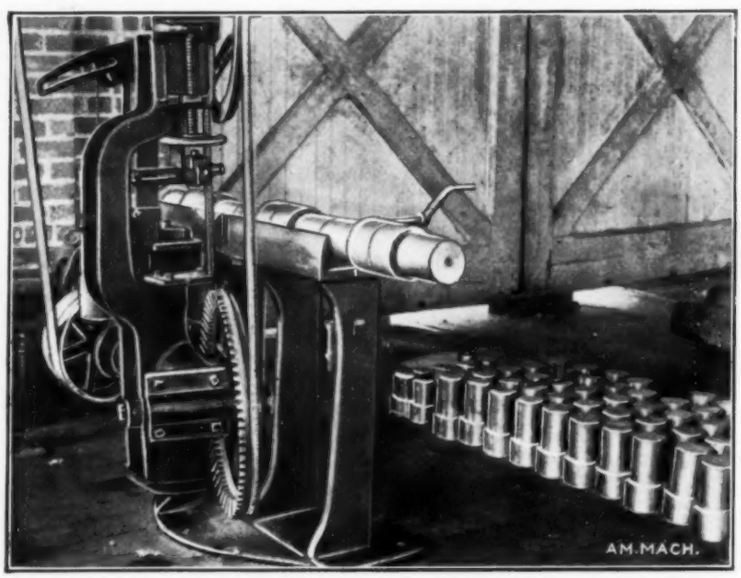


FIG. 8. BAND SAWS FOR CUTTING OFF METAL

lap enters the work. The space below *B* collects any overflow from the grinding material, and keeps it off the floor.

The head carrying the lap is fed up and down, so as to cover the length of the cylinder bore, at the same time the lap is being revolved by the motor. The feeding mechanism is controlled by air through the valve shown at the side.

The laps used are rather interesting and consist of a soft-steel lapping head, as shown in Fig. 6, which fastens to the end of the bar. This lapping head contains several oblong slots, as can be seen, into which lead plugs are fitted for holding the abrasive material, the plugs being the only part of the lapping head which comes in contact with the work. These lead plugs are cast to the proper shape and fit snugly into the pockets, which hold and drive them. They are so spaced that they overlap so as not to leave gaps between them, but form a continuous grinding surface, the whole length of the cylinder being operated upon.

FIG. 9. A PORTABLE OIL FORGE

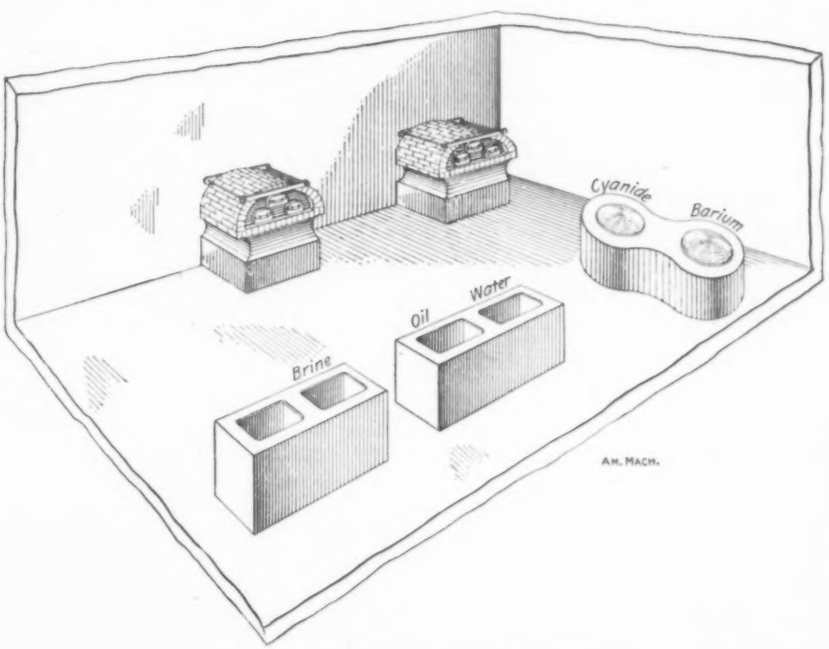


FIG. 10. GENERAL IDEA OF THE HARDENING ROOM

A MULTIPLE FIXTURE FOR SPIRAL GROOVES

In order to rotate the drill at every stroke, a spirally fluted piece is provided to give it the necessary rotation. These spiral flutes are milled in a rather interesting multiple fixture, as can be seen in Fig. 7, the novel part being that each pair of centers is offset a certain distance, as shown.

The amount of this offset must, of course, depend upon the angle of the spiral flute, as in order to mill all four pieces at once, the whole fixture must be swung at such an angle that the four milling centers will start to work at the same time. The angle of this offset is equal to the angle of the spiral to be milled, and the whole thing makes a very interesting fixture for producing rapid work accurately.

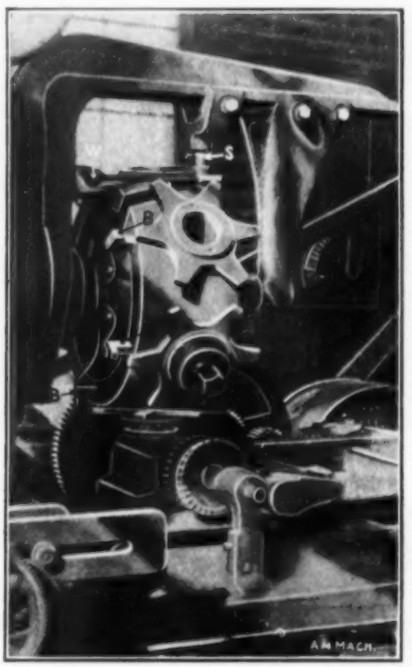


FIG. 11. AUTOMATIC MILLING ON A GEAR CUTTER

CUTTING OFF METAL WITH BAND SAWS

Band saws are used to a considerable extent in cutting up stock; one of these machines is shown in Fig. 8. They have the advantage of wasting very little material, and are reported to give very good satisfaction in this work.

A portable forge, which carries its own oil supply, and can be taken to any point

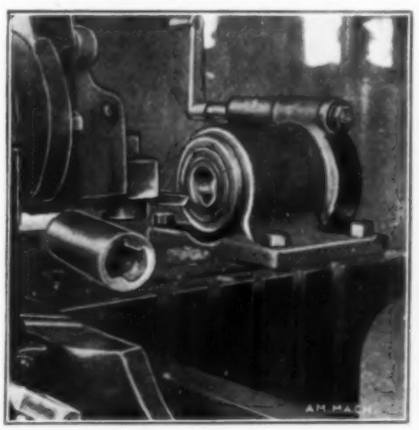


FIG. 12. A FIXTURE FOR THE SHAPER

of the shop for use is seen in Fig. 9. Compressed air is obtained by simply coupling the air connection to the most convenient air hose from the pipe line, which runs the whole shop.

A Concrete Hardening Room

The hardening room in this plant is quite unique, being constructed almost entirely of reinforced concrete. It was impossible to secure a photograph, owing to the insufficient lighting, but the illustration in Fig. 10 will give an idea of its appearance and construction.

The hardening furnaces are built up of reinforced concrete and firebrick in about the manner shown. The round furnaces for both the barium and cyanide are also of concrete in the form of a figure 8, the fire surrounding the crucibles in the usual way. The dipping tanks are of the same material, water, brine and oil being provided, so that any desired result may be obtained. In each case a uniform temperature is maintained by a forced circulation of the cooling liquid.

An interesting adaptation of a Gould & Eberhardt gear cutter for automatically milling hexagon caps is shown in Fig. 11.

A specially designed turret is mounted on the work spindle, as can be seen, this turret containing six holders for caps to be milled, so as to insure practically continuous operation. Each cap is held in a six-pointed holder, which serves to automatically turn the cap after it has been milled on two sides by the milling cutter *M*, and to revolve it into position for the next two sides.

The indexing is done by the stop *S*, which is fastened to the overhanging arm, which also supports the outer end of the work-holding turret. The indexing is accomplished in the same way as the usual star feed, common on boring bars and in similar places. Each work-holder is positively locked, so as to hold the work firmly, the locking being done by the hook bolts *B*, which project from the inner edge of the work turret.

These bolts hold the turret firmly locked, until they reach the upper portion of their travel. The locking bolt is withdrawn at this point by the hook coming in contact with a wedge or inclined plane *W*, which projects from the housing and which withdraws the locking bolt from its position of the work-holder. This allows the stop *S* to turn the work-holder one tooth, and as soon as the turret is indexed to the next position, the locking bolt again holds it firmly in place.

A Shaper Fixture

An interesting fixture for the shaper is shown in Fig. 12. This is for shaping out the end of the sleeve shown, so as to leave two lugs on opposite sides of the opening, as can be seen from the piece which is laid on the shaper tables directly under the clapper box.

The end of the sleeve is first laid off by a template, and the sleeve slipped into a split chuck, which holds it centrally in the fixture in correct position for the tool to shape out the metal each side of the lugs. The chuck portion of the fixture can be revolved by the crank handle shown, this rotary movement being controlled entirely by the operator. The fixture is very substantially made, and the same idea can be used in many other places.

Phonograph Machines and Devices

By Ethan Viall

An interesting series of drillers, reamers and fixtures used in the production of phonograph parts in large quantities.

Also a number of special tools and devices for rapid and accurate work on small parts.

Many of the machines used in the Edison Phonograph Works, Orange, N. J., are special machines built on the premises, or else made to order from special designs by some well known machine-tool builder.

As a rule, the castings for the bodies, motor frames and other standard parts for the various models, are machined on their own special group of machines, the jigs and tool setup not being changed at all except for resharpening, when necessary. The economy of this plan, where the output warrants it, will be at once seen by the practical shop man.

Combination Driller and Reamer

The machine used for drilling and reaming Home bodies, or tops, as they are sometimes called, is shown in Figs. 1 and 2. This machine has two multiple spindle heads *AA* and *BB*, at each end. The body casting *C* is carried in a fixture *D* bolted solidly to the cross-slide.

In Fig. 1 the drilling heads at the back of the machine are fed in by the handwheels *E* and *F*, additional leverage during the actual drilling being obtained by the hand levers *G* and *H*. As soon as the holes are drilled in the body casting, the drills are run back, the fixture is fed forward to a stop by turning the handwheel *I* and the heads carrying the reamers are fed in by means of the handwheels *J* and *K*. The rear view, Fig. 2, shows the fixture in position for reaming, the back stop being shown at *L* and one of the finished bodies at *M*.

Drilling Home Motor Frames

All the holes in Home motor frames, one of which is shown at *A*, are drilled at one setting in the four-head machine shown in Fig. 3.

The pads or bosses which come in contact with the body casting are first surfaced off in a miller, then the motor frame is placed in the fixture *B* against stops and the two clamps *C* and *D* put in

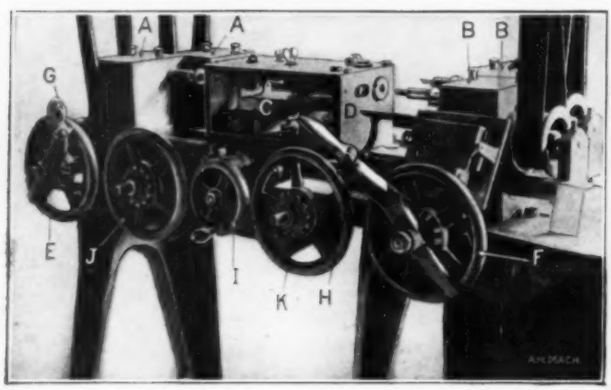


Fig. 1. Combination Drilling and Reaming Machine

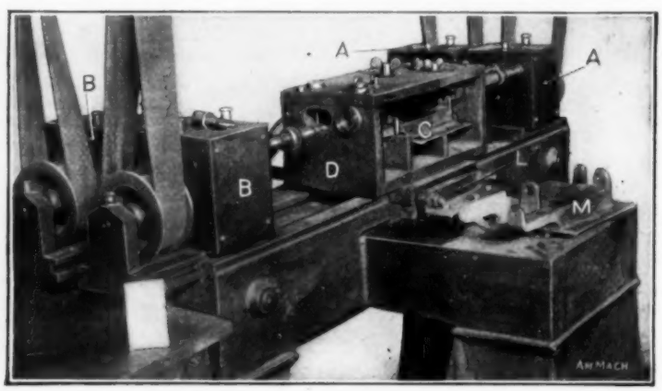


Fig. 2. Rear View of Driller and Reamer

position and tightened down. It will be noted that the clamp *C* swings into position, being hinged at one end and slotted at the other, so as to slide in under the clamping nut.

Clamp *D* is simply a plate slit for about two-thirds of its length, so that it will drop easily into place over the two bolts and under the wing nuts. This clamping arrangement makes it easy to hold or remove the skeleton-like casting.

The two side drilling heads are operated by the handwheels and the levers *E* and *F*; the top head carrying two drills is operated by the lever *G*, and the rear head *H* is worked by the lever *I*, ten holes in all being drilled by the four heads. Hand feed only is used, for, as a general thing, power feed is more trouble than it is worth in doing work of this kind. Fig. 4 gives a rear view of this machine and shows clearly the position of the parts not shown in the previous halftone.

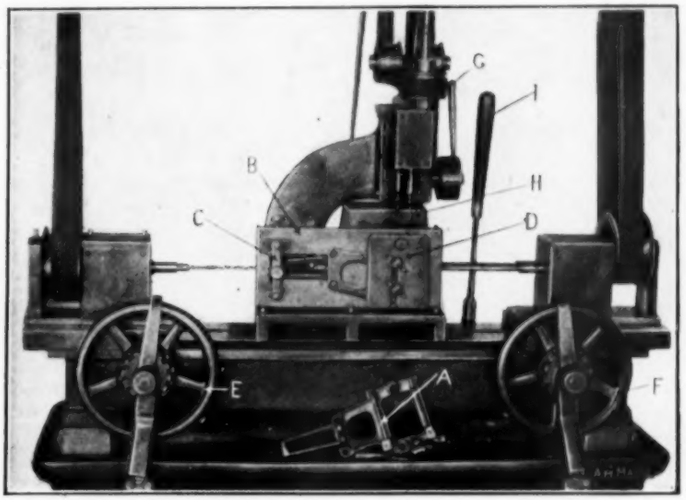


FIG. 3. FOUR-HEAD DRILLER FOR HOME MOTOR FRAMES

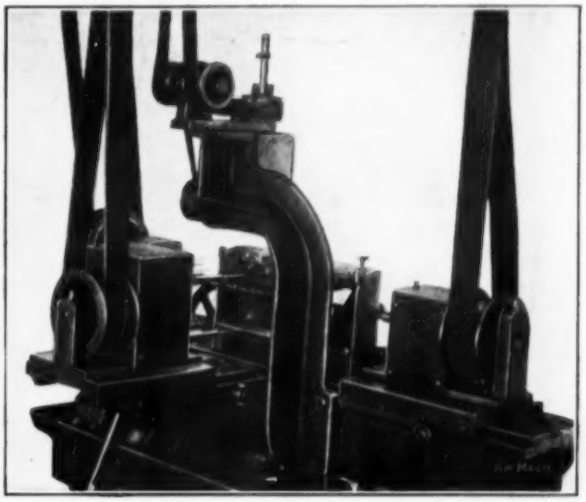


FIG. 4. REAR VIEW OF FOUR-HEAD DRILLER

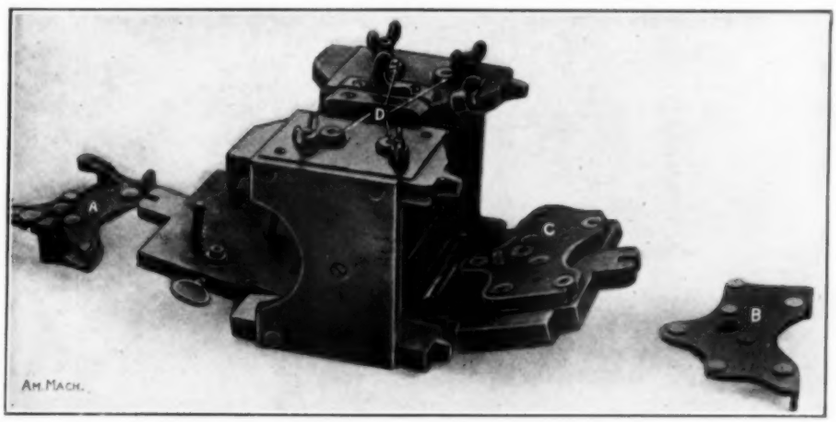


FIG. 7. JIG WITH BOTH COVERS OPEN

DRILLING FRAME SIDES

Both right and left frame sides for the Home models are drilled at once, using a multiple-spindle driller and the jig shown in Fig. 5. The next halftone, Fig. 6, shows the jig with one casting in position against the middle plate, and Fig. 7 shows the jig with both cover clamps open, the frame-side castings being shown at *A* and *B* and the inside of the plate, into which the drill bushings are set, at *C*.

From this it will be seen that the two castings are set against stops in the middle of the jig and are held in place by means of contact screws in the covers, the holes being drilled entirely through both pieces from one side, which insures

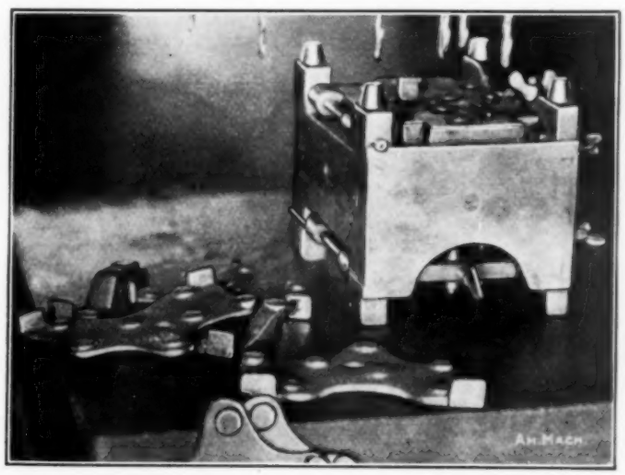


FIG. 5. JIG FOR DRILLING RIGHT AND LEFT FRAME SIDES

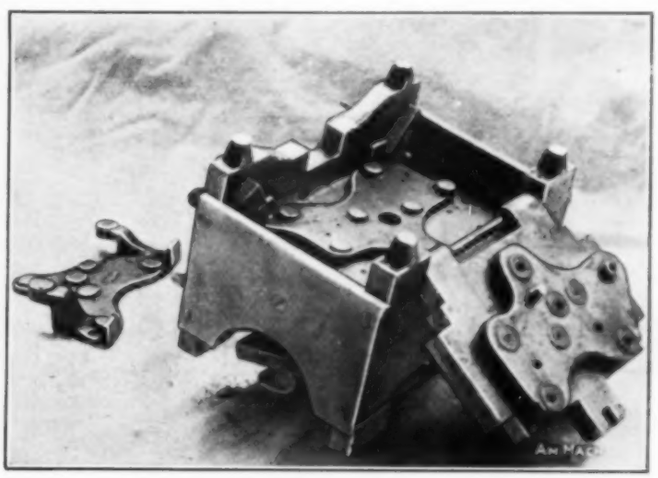


FIG. 6. CASTING IN PLACE ON MIDDLE PLATE

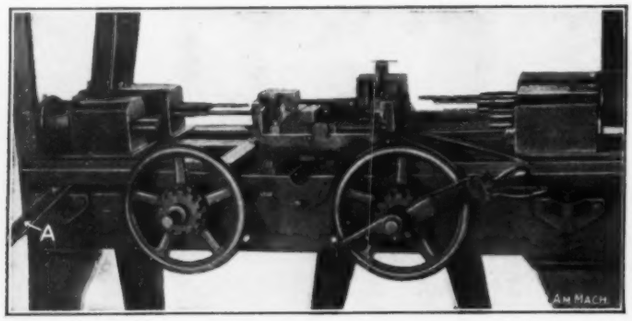


FIG. 8. MACHINE FOR DRILLING STANDARD TOP PLATES

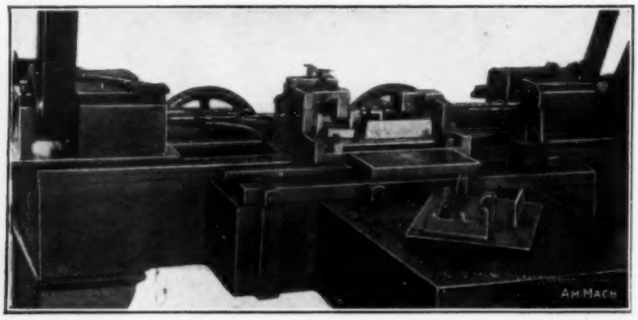


FIG. 9. REAR VIEW OF TOP-PLATE DRILLER

exact alignment. The holes in the lugs for the screws which fasten the sides to the frame are drilled from the bushings *D*.

MACHINES FOR STANDARD TOP PLATES

The machine for drilling Standard top plates, shown in front and rear views in Figs. 8 and 9, was built by the Garvin Machine Co. from designs of the Edison company, and is practically the same as those just described, except that the reaming heads were intended to be operated by levers, one of which is shown at *A*. These reaming heads are no longer used and the cross-slide screw has been removed.

The four holes for the motor frames and the four cabinet holes, are drilled at once from the bottom of the plate in the multiple-spindle driller shown in Fig. 10, which was built in the shop.

At the left in this halftone is shown a shelved box or crate, in which the machined castings are placed and carried from place to place. This is an easy method of handling the castings and prevents the breakage that would inevitably result if they were piled into trays or onto trucks.

BUSINESS PHONOGRAPH TOP PLATES

The parts of phonographs used for taking dictation in business offices in place of a stenographer, are heavier than the regular models and the three-head, multiple driller, Fig. 11, used to drill the top plates is a little more powerful than

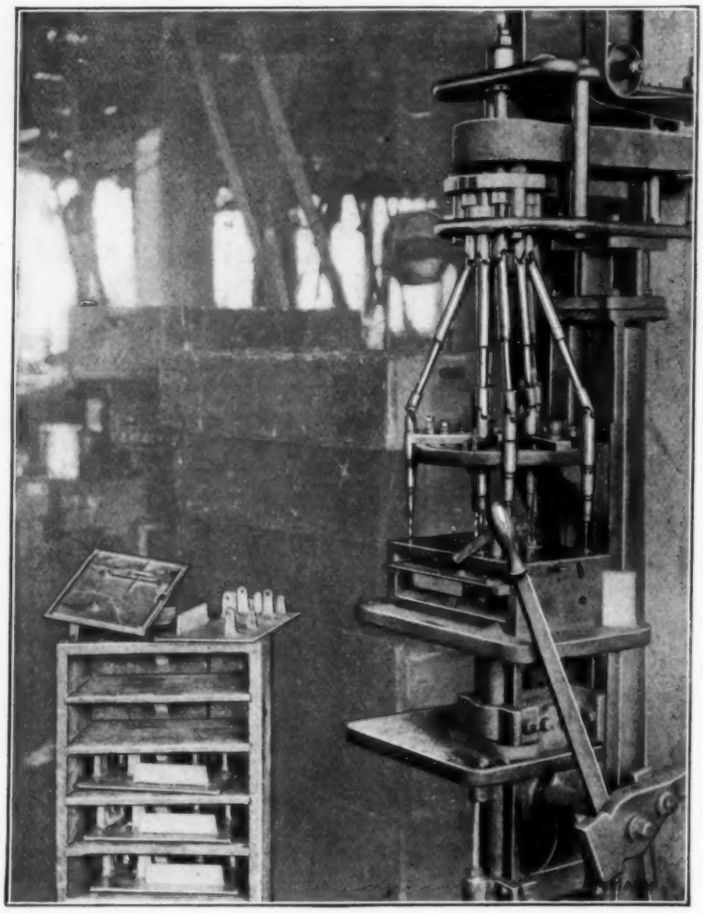


FIG. 10. DRILLING MOTOR FRAME AND CABINET HOLES IN STANDARD TOP PLATES

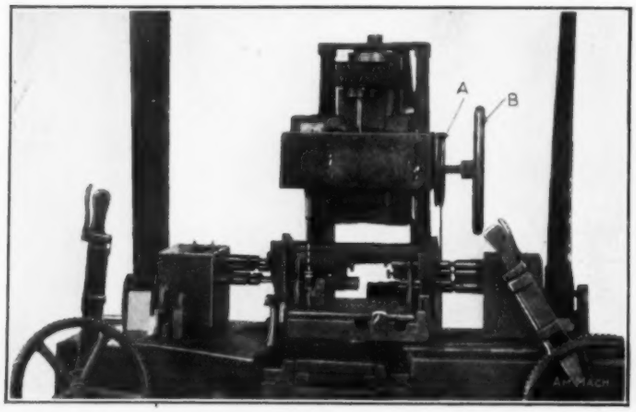


FIG. 11. DRILLING TOP FRAME OF BUSINESS PHONOGRAPH

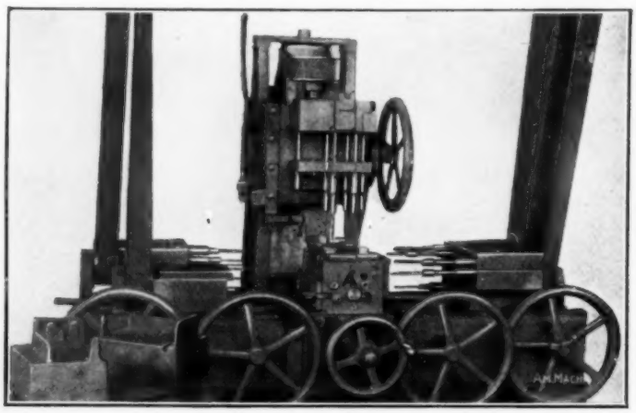


FIG. 12. DRILLING GEM BODIES

the others. Eleven holes are drilled with this machine, four in one end, five in the opposite end and two in the top.

The two end-head feeding levers are of extra length, strong and heavy and the dogs engage teeth in the rims of the handwheels, and not near the hubs as in the previous examples. The top head is of extra width owing to the distance between the two holes drilled; the head is counterbalanced by a weight and a cord running over the grooved pulley *A*, which is on the same shaft as the hand feeding wheel *B*.

The upper head in this machine is counterbalanced in the same way as the one used for business phonograph tops, but owing to the comparatively small drills used no levers are needed on the handwheels that feed the various heads.

On all of these castings where the drilling and reaming are not done on the same machine, the reaming is done on another of the same type as the ones shown.

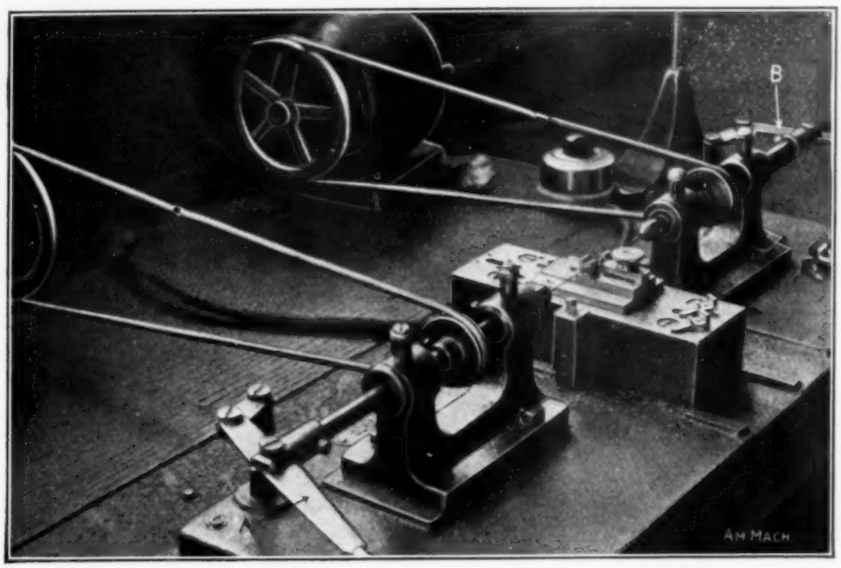


FIG. 13. BENCH DRILLER FOR BUTTON-ARM POST PLATE

THE GEM BODY MACHINE

The cheapest model of phonograph turned out by the Edison works is the Gem, the box and top plate being one solid casting, which is called the body. These bodies are drilled in the machine shown in Fig. 12, the body being placed in the fixture *A* on the cross-slide and five holes drilled in one end, six in the opposite end and five in the top. After these holes are drilled, the fixture is indexed a quarter turn, bringing it into the position shown in the halftone, and using the head *B*. Five holes are drilled in the side.

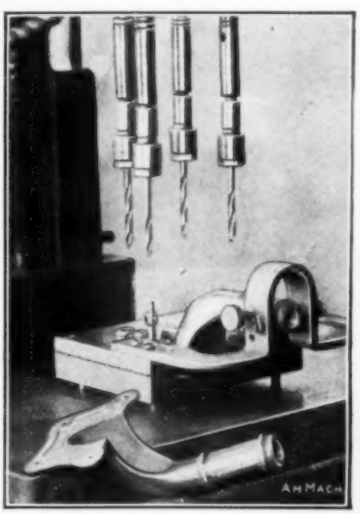


FIG. 14. DRILLING CABINET HOLES IN CRANE BRACKETS

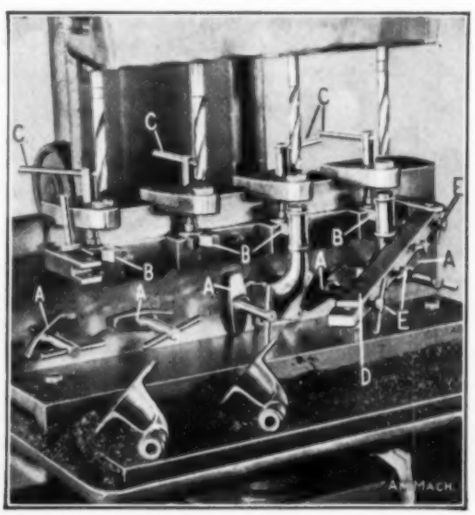


FIG. 15. JIG FOR DRILLING HORN CRANE-SOCKET HOLES

SPECIAL TWO-SPINDLE DRILLER

The brass, button-arm post plates for reproducers, used on the business models, are drilled in the bench driller shown in Fig. 13. The driller has two spindles, each driven by a small motor, and the drill spindles are moved by the hand levers *A* and *B*. The drills used are about No. 40, and the arrangement shown makes a very satisfactory device for the purpose, a boy handling the pieces very rapidly.

DRILLING HORN CRANE BRACKETS

Cast-iron brackets used to hold horn cranes are first drilled for the cabinet holes in a multiple-spindle driller while held in a jig as shown in Fig. 14, the four holes being drilled at once; they are then placed, four at a time, in the jig shown in Fig. 15, and the four ½x2¼-in. socket holes drilled simultaneously.

In this jig the pieces are located by means of the drilled holes, which fit over dowel pins in the body of the jig. Next they are clamped by means of the clamps *A* and then the V-blocks *B* are adjusted to the necks by the lever *C*. The bar *D* is now swung into place and locked with a pin, and the thumb-screws *E* tightened when the brackets are ready to be drilled. The socket holes in these brackets are drilled at the rate of about 800 per day.

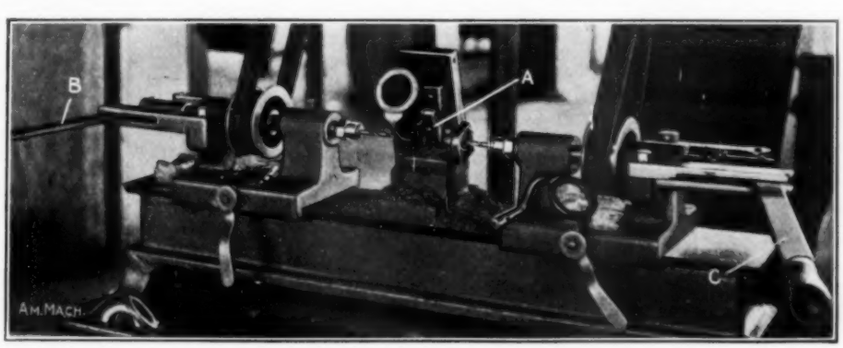


FIG. 16. DRILLING BACK-ROD HOLE IN SPEAKER ARMS

DRILLING SPEAKER BRACKETS

The cast-iron brackets that carry the recorders or reproducers are called speaker arms and these are drilled out for the back rod in the machine shown in Fig. 16. The arm is clamped in the fixture between two drill bushings, the hinged clamp *A* operated by a handscrew

at the back, pulling the slide of the arm solidly down onto two V-blocks. Then the holes are drilled through the two solid ends of the slide, by pulling on the hand levers *B* and *C*, which operate the two drill spindles. The two drills do not meet as the middle of the slide casting is cored out and open on one side for about half its length. After being drilled, the arms are placed in a special chuck in a screw machine, and the ring bored and faced for the speaker.

Threading Clamping Rings

Brass clamping rings used to hold the diaphragm in the speakers, are first bored out while held in a spring chuck in a screw machine, then they are faced off to the required thickness and threaded on the outside in the machine shown in Fig. 17.

A ring, several of which are shown at *A*, is placed on the split chucking mandrel *B* with toothed or corrugated side next to the flange of the mandrel; then the mandrel is expanded by screwing in the plug *C*, which is knurled on the outside to afford a good grip for the operator; next the machine is started and the tool *D* fed down by pulling on the lever *E*, which cuts the ring the proper thickness and chamfers it. The next operation is to cut the ring to the right diameter with the tool *F* and then the thread is chased on with the formed chaser *G*, the teeth of which are made like those of

Fig. 18. Milling Weight Standards

a taper tap, so that one pass completes the thread.

Milling Weight Standards

The weights used to keep the sapphire points of the speakers in contact with the wax cylinders have a small pin or stud set into them by which they are connected or hinged to the sapphire carrier. This pin is called the "weight standard" and after it is set into the weight it is split and straddle milled to make it in the form of a fork, which is done as shown in Fig. 18.

The weight *A* shown in the halftone is for a model N speaker, but all the weights are milled in this machine, different holders being used. The weight is placed on the fixture over a locating pin which fits the hole *B*, and the split end *C* fits over a small block; then the clamp is pressed down by the operator gripping the handles as he feeds the pin *D* to the gang of three cutters at *E*, which consists of a thin saw and two milling cutters. A stop *E* is provided so that the operator won't swing his fixture too far and cut into the weight.

Milling Spiral in Back Rods

The guide or back rods for the business models, have a spiral groove cut in them on account of the dust and dirt that

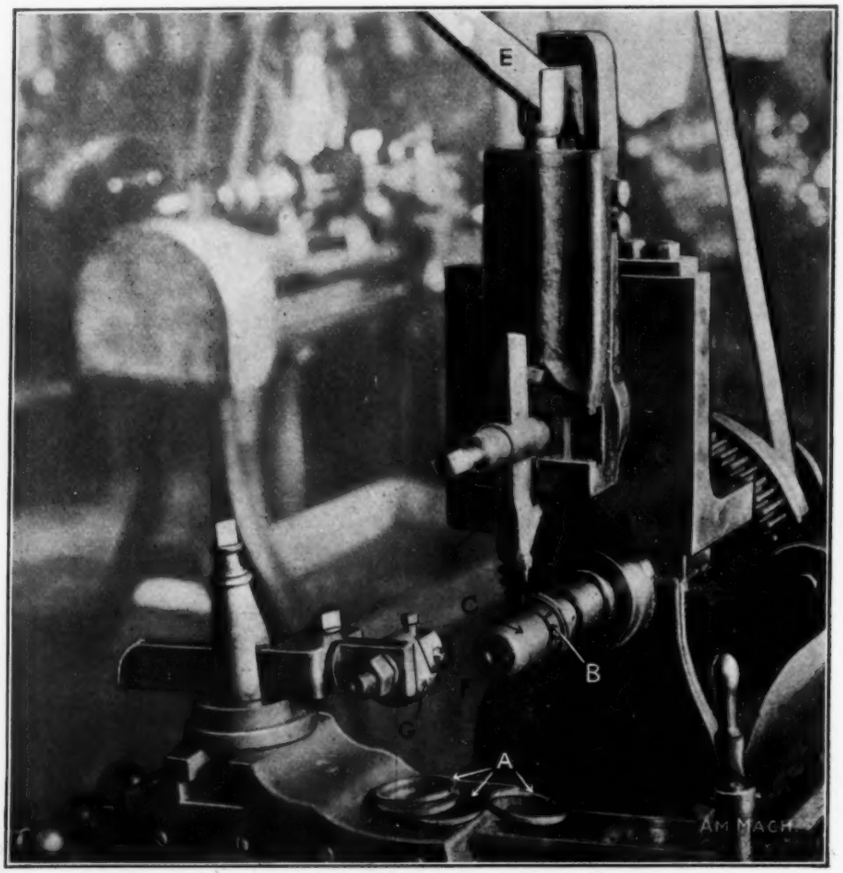


Fig. 17. Threading Clamping Rings for Speakers

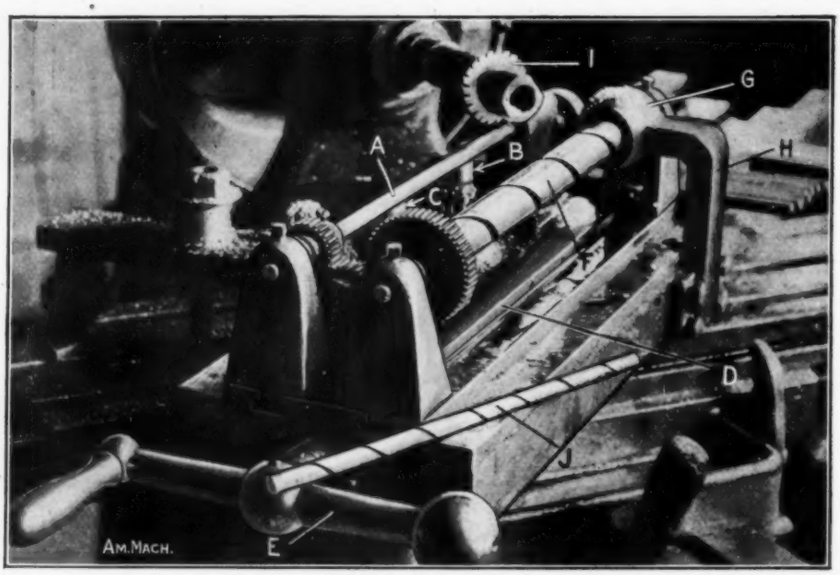


Fig. 19. Milling Spiral in Back Rods for Business Phonographs

is sure to collect on them when in use. These spirals are cut in the special fixture shown in Fig. 19.

The centered rod to be milled is placed at *A* between centers with a driver on the geared end, and two steady rests *B* and *C* under it. As the carriage *D* is fed forward by means of the ball crank *E* the master spiral *F* is caused to turn by a nut *G* in the bracket *H* bolted to the bed of the fixture.

The master spiral is connected by gears to the spindle on which the rod is placed, so that as it turns the rod is correspondingly rotated under the cutter *I*. One of the finished back rods is shown at *J*.

Lapping Ends of Standard Spindles

One end of the spindles used on the Standard models is hollow and the finai lapping to make them as smooth as possible, is done in the machine shown in Fig. 20.

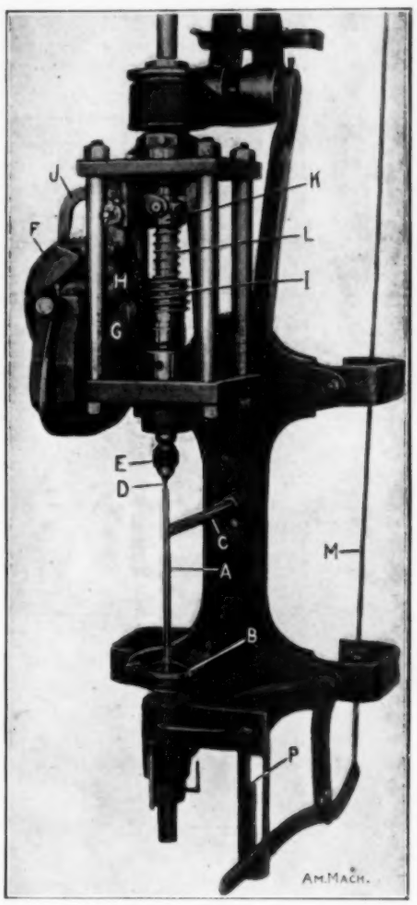


Fig. 20. Spindle-lapping Machine

The spindle *A* is placed on the lower spring center *B* and held against the steady rest *C* by hand. A spring lap *D* is held in the chuck *E* and revolved rapidly, and at the same time given an up-and-down movement by the two cams *F* and *G* on the worm gear *H*.

The worm gear is driven by a worm *I*, which is keyed to the spindle in such a way that the spindle is free to slide up and down in it. As the worm gear revolves the cams *F* and *G*, each in turn strike the lever *J* fastened to the collar *K* on the spindle and force it down. When the lever drops off the end of one of the cams the spring *L* forces the spindle up, the combination giving the lap the motion alluded to.

The countershaft belt-shifter is operated by the cord *M* and lever *N* and when the lever is pulled up and set into the notch *P* the machine will run, but releasing the lever allows a spring to pull the shifter back and the drive belt runs on the loose pulley.

Reaming Gear Blanks

Small brass gear blanks are reamed in the fixture shown in Fig. 21. The blank, while being reamed, is held between the two V-blocks *A* and *B*, of which *A* is stationary and *B* sliding, being operated by lever *C*. As soon as a blank is reamed the lever *C* is shoved back and another blank is pushed into the V's, the act of pushing in another blank, of course, pushing the finished one out.

Larger brass gear blanks, which have been blanked and pierced in a punch press from sheet metal, are reamed as shown in Fig. 22, being held by hand on a three-point bearing block *A*.

Fig. 21. Reaming Small Gear Blanks in Special Fixture

Fig. 22. Reaming Larger Gear Blanks

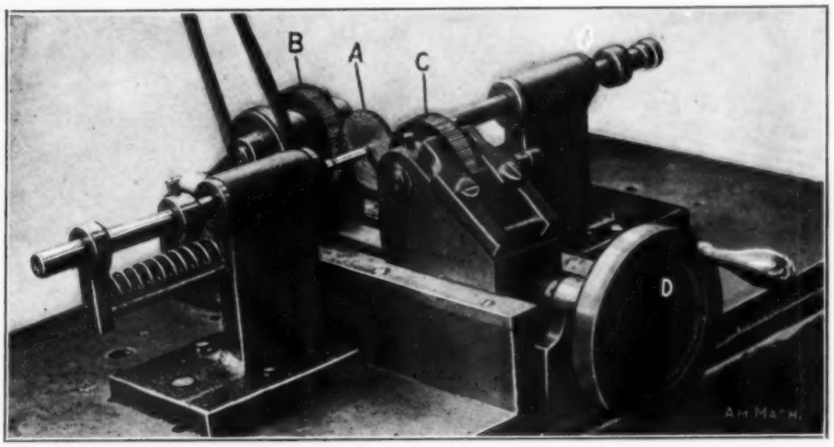


Fig. 23. Knurling Brass Gears

Knurling the Gears

After the large gear blanks just shown are reamed, they are placed 10 or 15 at a time on mandrels and turned to within 0.005 in. of size. Then the teeth are cut in an automatic hobber, after which they are chucked true by the outside of the teeth in a special chuck, and the hole bored true. Next they are run between hardened steel knurls as shown in Fig. 23, to properly finish the teeth.

In this halftone *A* is the brass gear and *B* and *C* are the knurls. At the start the knurls are, of course, run back and then gradually fed in to the right depth by turning the handwheel *D*, which feeds both knurls in at once. This method takes out any burrs that might be between the teeth and so shapes them as to produce a smooth, quiet running gear. Of course, it is only necessary to treat the fine-toothed gears in this way.

A Kansas City Automobile Factory

By F. A. Stanley

The Stafford car is built with the aid of simple, efficient tools which enable the four-cylinder motor parts and other work to be machined to advantage.

Boring and grinding cylinders on a lathe with special attachments; drilling connecting-rod ends in a centering jig; babbitting and finishing crank-case bearings.

Jigs and fixtures for other operations.

The accompanying engravings illustrate a few special tools seen during a recent visit to the shops of the Stafford Motor Car Company, Kansas City, Mo.

Machining Cylinders

This company's method of boring cylinders is represented by Fig. 1, which shows a two-cylinder casting on a fixture attached to the faceplate of a Bradford lathe. The boring bar is carried in a saddle on the lathe carriage.

The cylinder casting is formed with sloping faces at the top as the valve openings are put in at an angle, and before the cylinders are bored the work is placed on an angle plate on the miller and a vertical attachment is used for machining the sloping faces at the proper angle. These surfaces are finished a certain distance from the tops of the cylinder dome in order that a definite thickness of metal may be preserved at this point. Then the casting is turned over on a suitable fixture and the flanged base is milled. The drilling of the flange follows and the cylinder is now ready for the boring operation, Fig. 1.

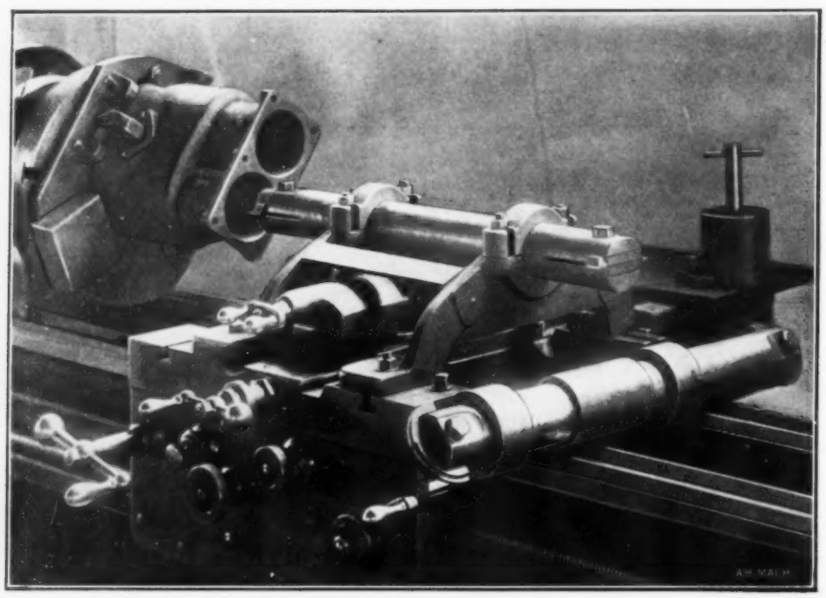


Fig. 1. Boring Cylinders

The Boring Tools

The fixture for holding the cylinders on the faceplate provided means of locating the work easily and the hook bolts and setscrews shown secure the casting firmly in place.

The boring bar is double ended, and the method of securing it in its seat in the saddle is such that it may be turned end-for-end in a moment, so that it is feasible to carry roughing cutters in one end and finishing cutters in the other. The cutters are all single ended, but two are carried in each end of the bar as shown by the sketch, Fig. 2. This allows the cutters to be easily made and kept in good condition, and also forms a satisfactory method of adjusting them to cut to proper diameter, so that they may be used a long time before they are worn out.

The rough boring cutters are run in to a definite depth as established by a hardened stop on the side of the holder for the bar which comes in contact with the base of the cylinder. Then the bar is removed from the holder and the doming bar, Fig. 1, is put in place. This also has roughing and finishing cutters at opposite ends, of the form shown in the halftones, Figs. 1 and 3, and in the sketch, Fig. 2.

Bar and Cutters for Cylinder Dome

The semi-circular cutter for machining the cylinder dome is lipped like a drill as indicated in the sketch and cuts the metal freely and smoothly. The bar is provided with bushings which steady it in the cylinder bore and the bushing for the roughing end of the bar fits the bore produced by the roughing cutter in the boring bar, Fig. 1. After the dome is roughed out, the boring bar is replaced and the pair of cutters at the other end of the bar finish the hole to within a few thousandths of size this allowance being left for grinding. The finishing cutter for the dome is then run in, with the bar guided by another bushing which fits the bore produced with the finish boring cutters. The bore is then ready for grinding to size.

The cutters for finishing the dome are fed to a certain depth determined by the stop in the fixture coming in contact with the cylinder base, in the same way that the boring cutters are prevented from entering too deeply.

The Grinding Process

The operation of grinding is accomplished with the attachment illustrated in Fig. 3, which is made up of a home-made grinder quill and spindle, a head for receiving the quill and a U. S. electrical tool grinder at the rear for driving the wheel spindle, the portable grinder wheel being replaced with a belt pulley.

The head with the quill drops in between the sides of the boring-bar fixture on the lathe carriage and is secured to the top of the compound rest. It is held by a tongue and single bolt, so that a turn of a wrench is all that is required to clamp the attachment in place or release it upon completion of the grinding operation. With this arrangement the bore is ground to exact size as tested by the plug gage.

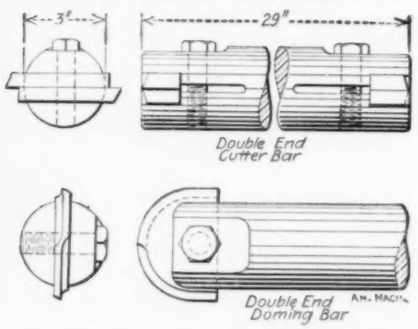


Fig. 2. Boring and Doming Tools for Cylinders

A Boring Mill Operation

The Colburn vertical mill in Fig. 4 is represented as equipped with an angular fixture for holding the cylinder casting at the required angle for the machining of the openings for the valve seats. The

work is slid between stops for establishing the positions of the openings at the required center distances. Three cutter bars are carried in the turret, each with a pair of cutters of the type already shown for cylinder boring and these bring the opening to within 0.002 in. of size. The reamer then finishes the hole.

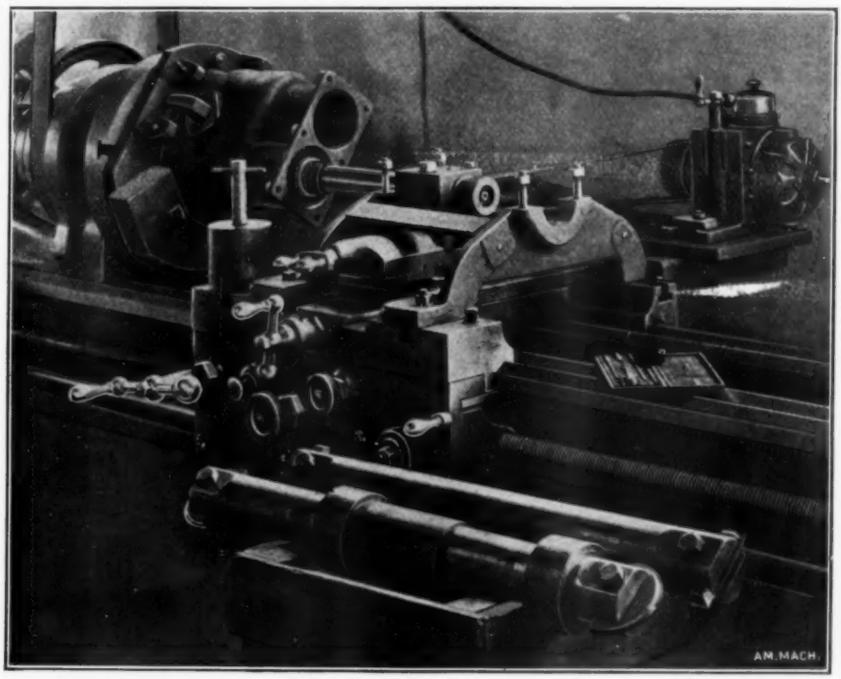


FIG. 3. GRINDING CYLINDERS

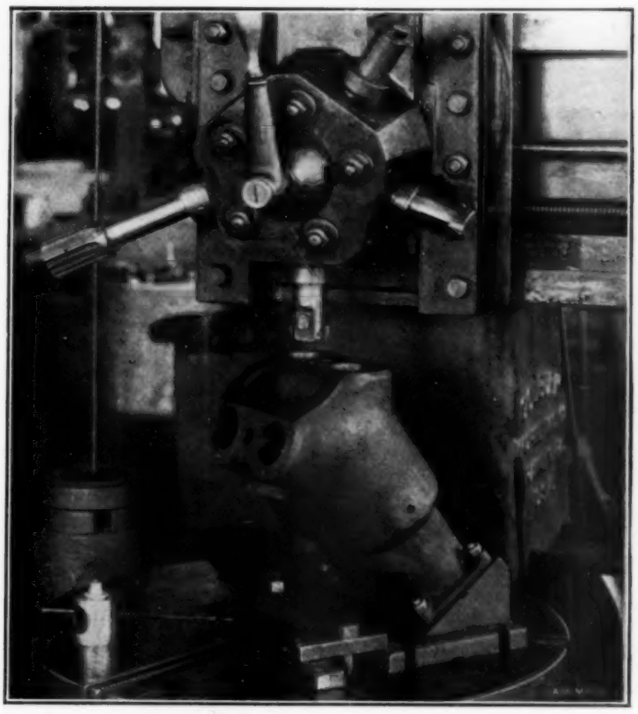


FIG. 4. BORING VALVE OPENINGS

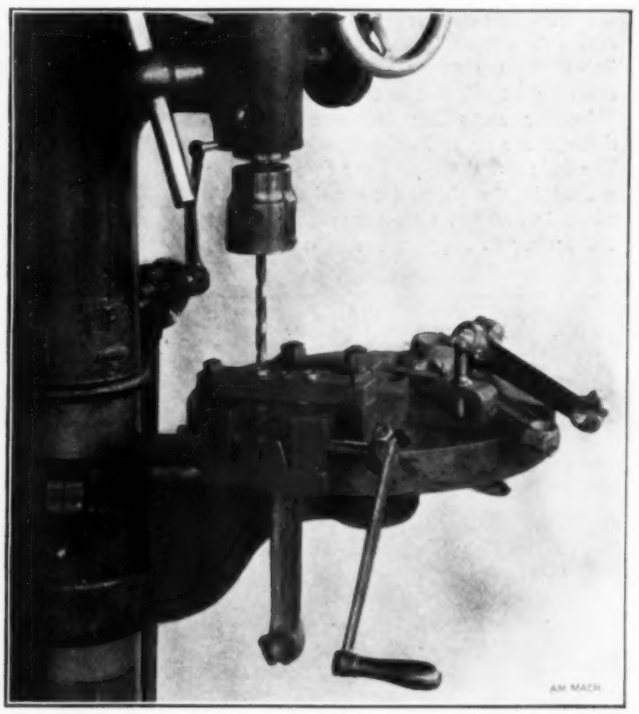


FIG. 5. DRILLING ENDS OF CONNECTING RODS

A CONNECTING ROD JIG

The jig in Fig. 5 holds connecting rods by the large end for the drilling of the holes for the cap studs, and for drilling a centering hole in the end. The jig is provided with a pair of clamp jaws operated by right- and left-hand screw which secure the rod in central position under the fixed drill bushings. The jig is clamped to the driller table so that the work clears the edge as indicated.

The rough forgings come first to this jig and after the operation shown is completed the rods are rough bored in another fixture on the miller. They are then centered at the small end by the small jig seen at the right on the table in Fig. 5. This jig has a locating stud which is slipped through the rough-bored hole in the small end of the rod and a thumb screw holds the rod sufficiently tight for the centering operation, which is accomplished in a sensitive driller.

The centers in the two ends form accurate means of locating the rod in a device for finish boring and facing of the bearings at the ends.

CRANK CASE TOOLS

A group of crank-case tools is illustrated in Fig. 6. The large jig in the foreground drills the holes in the upper and lower halves of the case including the stud holes for the two pairs of cylinders; the holes for the bolts which fasten the two case members together, etc.

The babbitting mandrel for the main bearings is represented at *A*, and the cap babitting arbor at *B*. These tools are provided with locating pads and pins which allow them to be placed exactly in position and sliding collars are included which are readily adjusted to the ends of the bearings. Anchor holes are, of course, drilled before the metal is poured, and the bearings are afterward thoroughly peened.

The caps are bored in a special fixture by themselves. The bearings in the case are prepared for scraping by a special form of file shown at *C*. This is a long steel bar with a fine-tooth surface formed by cutting a close pitch thread nearly the full length. This is passed lightly back and forth through the

three half bearings in the case, removing inequalities in the surface and leaving a half-round box which needs little work with the scraper to give it a proper bearing for the crankshaft.

Miscellaneous Jigs and Fixtures

The jigs and fixtures in Fig. 7 are for handling a variety of parts and may be briefly explained as follows:

The fixture *A* is for holding pump cases for certain facing operations and the casting is held upright by an adjustable post at the right side and a stop pin under the flange at the upper left corner. The clamp carries a single screw at the upper end which acts upon the lug extending from the rear of the pump casing.

The jig at *B* is for drilling rear engine hangers. When the top clamp is removed, the work drops over the walls of the jig and is then secured by the clamp at the top and by thumb-screws at each side.

The cylindrical jig at *C* drills an interlocking plate for the transmission. The bushings are all in the rear of this jig, the view showing the means of clamping the work in the front.

Other Tools

A transmission-slide-cover jig is shown at *D*. A hole for a shaft bearing is bored through the boss on this cover before the piece is placed in the jig and the work is here slipped over a locating stud as represented so that all the screw holes for the cover will be positioned correctly in relation to the bearing.

Rocker arms for valves are drilled through the forks in the jig shown at *E*. The hole bored through the hub fits over a stud in the jig and an adjustable V-block is brought up against one end of the rocker to support the fork which is seated at the top, against the end of a setscrew.

The rocker arm support is drilled in the jig *E*. It is bolted against the face of the jig with the forks supported by screws between the two lugs at the end. In drilling the fork holes an auxiliary bushing shown on the pin in the fore-

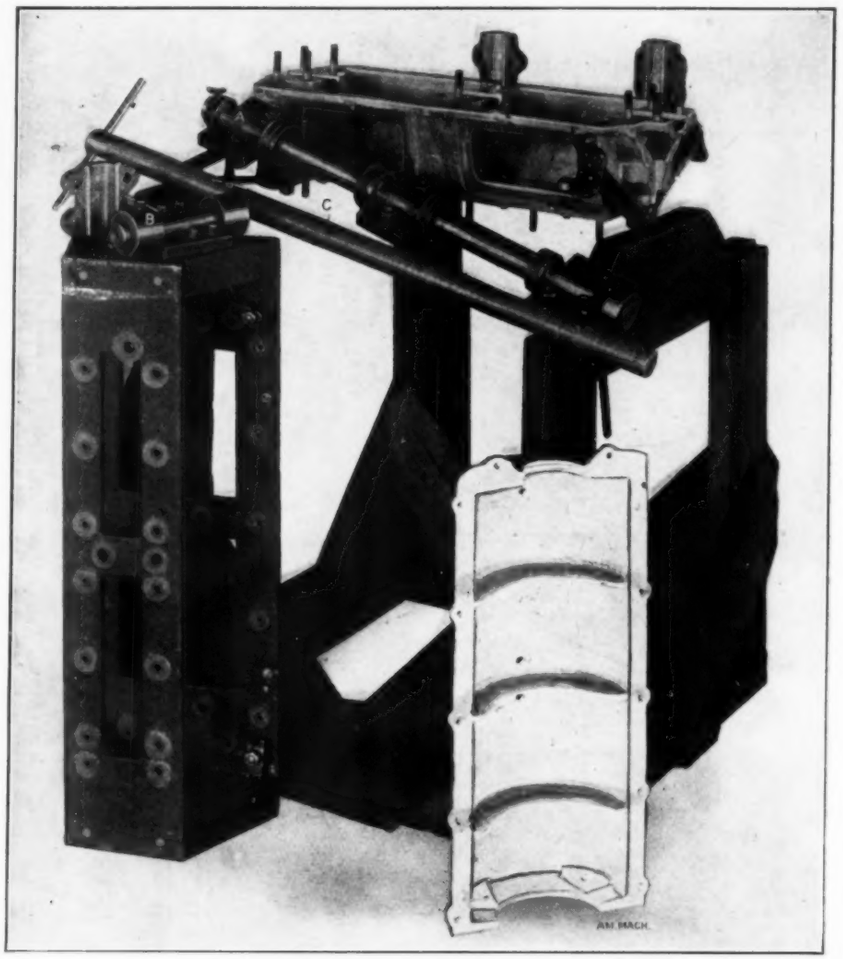


Fig. 6. Crank-case Tools

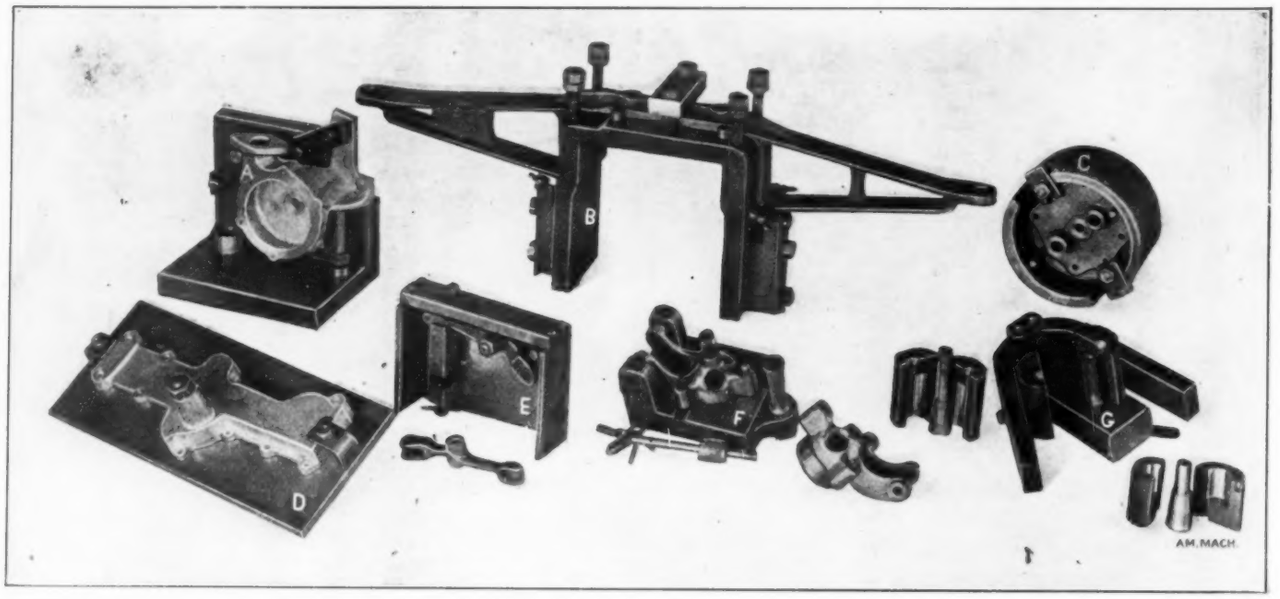


Fig. 7. A Group of Jigs

FIG. 8. A BUILT-UP FRAME JIG USED FOR DRILLING ALL HOLES IN THE FRAME WITH THE EXCEPTION OF THOSE FOR ENGINE HANGER

ground, is slipped between the two forks to provide additional support. The pin is afterward slipped through the fork for security during the drilling of the stud holes through the body of the work from the rear of the jig.

MOLDS FOR BABBITT BUSHINGS

Some babbitting tools are shown at *G*. They are used in casting bushings for vertical shaft bearings. The fixture proper consists of a split mold opened and closed by a pair of swinging jaws attached to a suitable base plate. At the center of the plate a removable plug is located for forming the interior of the bushing.

Several sets of molds and center plugs are shown in the group, these being readily changed as required to produce the different sizes of bushings needed. It will be noticed that the plugs are formed with tapered bodies so that they are seated tight in the base by driving them lightly from the rear. They are removed also by a light hammer blow.

FRAME JIGS

Fig. 8 illustrates a pair of frame drilling jigs built up of flat stock and adapted for drilling all the holes in the frame with the exception of those for the engine hangers. The jigs are right- and left-hand and are secured to the work by ordinary clamps. It will be noted that while the jigs are comparatively light, considering their size, they are of rigid construction.

Boring a Long Hole

BY E. A. DIXIE

The halftone shows a hydraulic cylinder being bored in the engine lathe. This job was done by Frank Loyot in the shops of the Waterbury Farrel Foundry, Waterbury, Conn.

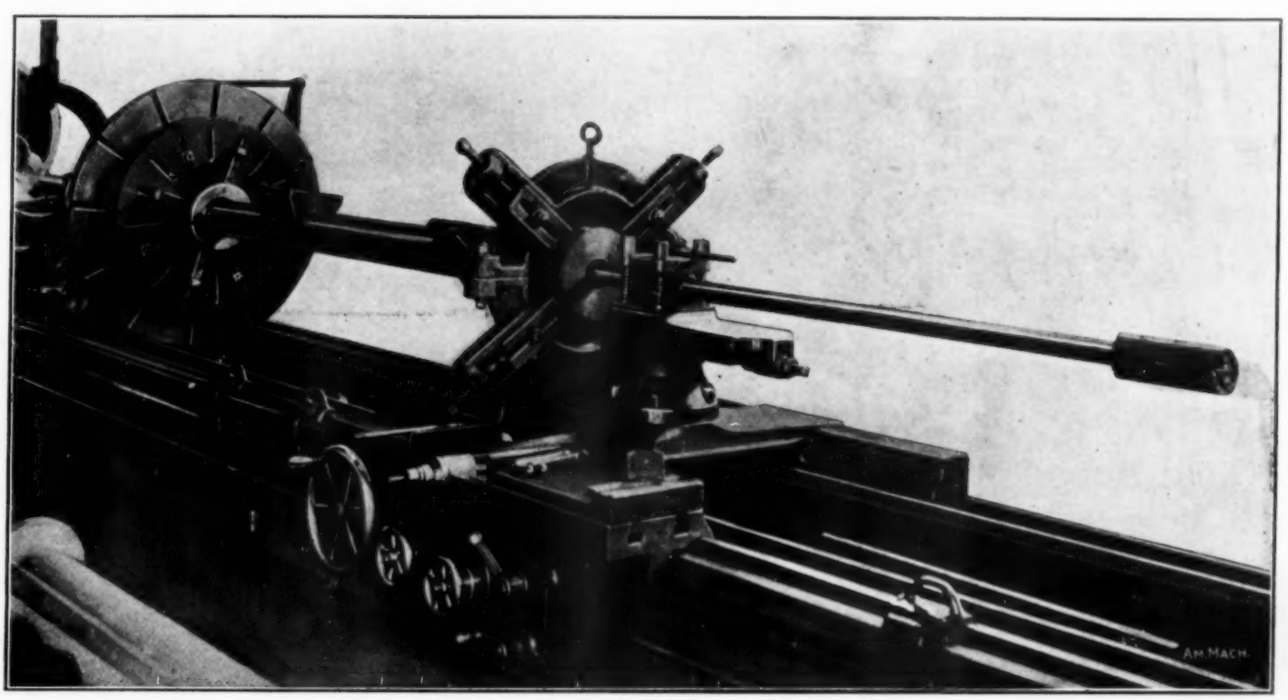
The iron casting is 9 ft. 2½ in. long and has a 3-in. hole cored in it from end to end. The flanges on both ends are first turned and faced, the casting being held on centers. It is then chucked at one end and the other end run in the steady rest, as shown.

In order that the boring tool may run true, an ordinary single-point boring tool is used to true up the hole to a depth of 10 or 12 in.

The boring bar used for the deep bore is splined from end to end and a key in the special tool post fits this spline, preventing it from turning. Both ends of the boring bar are slotted to receive the two lipped cutters, one of which is shown on the wing of the carriage just below, and in front of, the slide-rest. Cylindrical lagging of hard maple about a foot in length is secured to the end of the bar. This is shown plainly at the right of the halftone.

The finished cylinder is 4 in. in diameter. Two roughing cuts, one ¼ in. deep and one $\frac{3}{16}$ in. deep, are taken. The final finish is a single cut $\frac{1}{16}$ in. The finished bore must be true to size and straight. The total time was about 13 hours.

The drill shown is probably the oldest form of deep-hole drill and while it is simpler, it is just as efficient as the modern gun drill.



LONG-HOLE BORING ON THE ENGINE LATHE

Making a Clip in the Punch Press

By E. A. Suverkrop

An interesting piece of work involving the use of the screw machine, punch press and dies for swaging, bending, trimming and embossing.

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The halftone, Fig. 1, shows a small clip made from a single piece of brass in the shops of the Ryede Specialty Works, Rochester, N. Y.

Owing to the duty this piece has to perform it was considered advisable to make it in one piece. This is not only stronger than a two-piece clip but a hard soldering operation, more or less difficult on such small work, is eliminated.

First Operation

The first operation is done in the screw machine and consists of cutting $\frac{7}{32}$-in. brass wire into suitable lengths.

Second Operation

The second and subsequent operations are shown in sequence in Fig. 2 and are marked from 1 to 7 respectively. The small cylindrical brass piece shown at *A* is placed in the opening *D* in the die shown in Fig. 3 between the jaws *B* which are caused to swing on the pivots *C* by the inclined surfaces *E* coming in contact with the surfaces *F* on the punch *H* as it descends. The jaws *B* are swung together and squeeze or swage the shank *C*, Fig. 2. The punch *H* goes on down and the inserted hard-steel piece *G* flattens the top as shown at *D*, Fig. 2.

Between the jaws *B* in the die shown in Fig. 3 there is a spring plunger which acts as a stop to prevent the blank from being set in too deep.

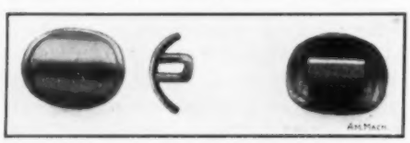

Fig. 1. The Finished Clip

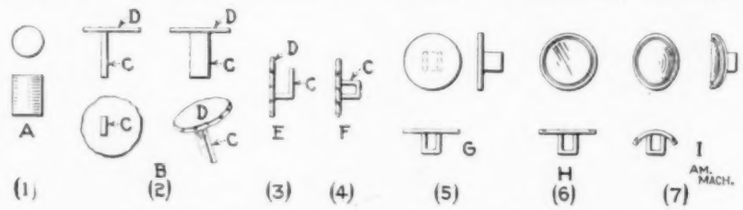

Fig. 2. The Seven Operations on the Clip

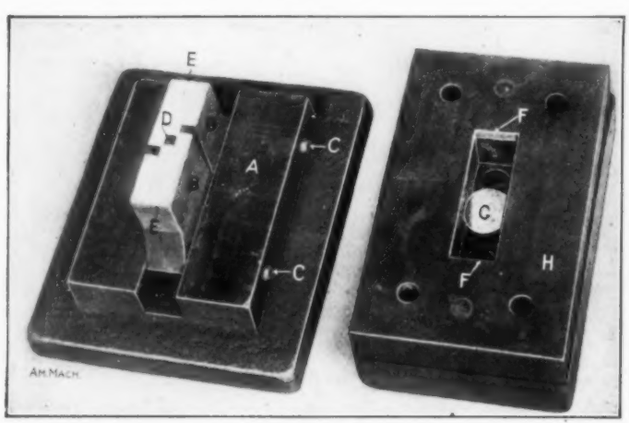

Fig. 3. Second Operation—Swaging the Blank

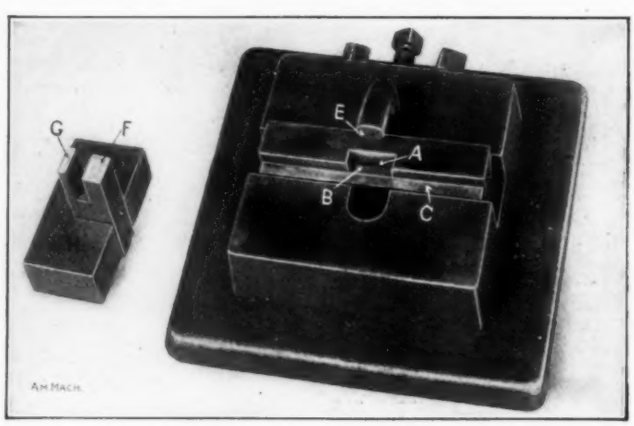

Fig. 4. Third Operation—First Bend on Tail

Third Operation

The blank as shown at *B*, Fig. 2, then goes to the die, Fig. 4. The member *B* is a tool-steel pad supported by a spring. Behind it is a narrow slot *A* to accommodate the one side of the head *D* of the piece *B*, Fig. 2. The member *C*, Fig. 4, is also tool steel set solid in the holder. The front edge of it next to the opening *D* acts as a shear for trimming the tail *C* of the part *B*, Fig. 2, to length. The part *E* acts as a support for the punch *G*. The opening *D* permits the shear *F* to pass the face of the shear *C* and also acts as a means of egress for the trimmings.

The action of the die is as follows: The blank as shown at *B*, Fig. 2, is placed in the die, Fig. 4, with half the head *D* in the slot *A* and the tail *C* extending at right angles across *B* and *C* to the opening *D*.

The punch-holder *H* with the forming punch *G* and shear *F* descends. *G* engages the blank and *F* shears the tail to proper length. As the punch goes on down, the blank is held between it and the spring pad *B*, and the back edge of *C* bends the tail up at right angles as shown at *E*, Fig. 2. On the return of the punch to top position the spring pad *B* rises and the piece is easily removed. The shear *F* is slightly in advance of the punch *G*.

Fourth Operation

The blank shown at *E*, Fig. 2, then goes to the die, Fig. 5. Half of the head is put in the slot *A* with the bent tail *C* as shown at *E*, Fig. 2, up and the edge of the head against the stop *B*. The rectangular forming pin *C* is then advanced by means of the handle *E* to which it is fastened. The angular punch *D* then descends and makes the second bend in the tail while the forming pin *C* supports it on the inside. The blank now appears as shown at *F*, Fig. 2.

Fifth Operation

The blank *F*, Fig. 2 is now placed in the die, Fig. 6. The bent tail *C* seats in the rectangular opening *A* in the spring locating pad. The hollow punch, or die, *D* descends and trims the edge of the head, and the face of *D* coming in contact with the two scrap shears *C*, shears the scrap which falls out of the way. The knockout *E* ejects the trimmed blank from the punch *D* when it returns to top position. The blank now appears as at *G*, Fig. 2.

Sixth Operation

The blank *G*, Fig. 2, now has the ring embossed around the edge. The simple

punch and die shown in Fig. 7 are used for this purpose.

The blank is placed face down in the die *A* which has an annular knife edge to form the ring. In the center of *A* is a loose cylindrical pin which in connection with a lever inserted in the opening *B* acts as a knockout. The punch *C* is cylindrical as shown. The opening accommodates the bent tail. The blank now appears as shown at *H*, Fig. 2.

SEVENTH OPERATION

The two jaws *B*, Fig. 8, are tapered and rest on springs. The blank *H*, Fig. 2, is placed between them with the bent tail in the opening *A*. The rectangular former pin *C* controlled by the lever *E* is then pushed through the rectangular opening in the bent tail so as to support it and prevent deflection while the head is being formed to an arc.

The punch is very simple, the face shaped as shown. When it descends the blank is squeezed between it and the wedge-shaped blocks *B*. These are pushed down against the pressure of their springs and their wedge shape causes them to close on the bent tail.

As previously stated the former pin *C* supports the rectangular opening in the tail and prevents distortion. When the punch rises the blocks *B* also rise, being pushed up by their springs; they open slightly, the former pin *C* is withdrawn and also the finished piece as shown in Fig. 1. The lever *D* to the left in Fig. 8 is used to raise the die blocks *B* should they for any reason refuse to rise.

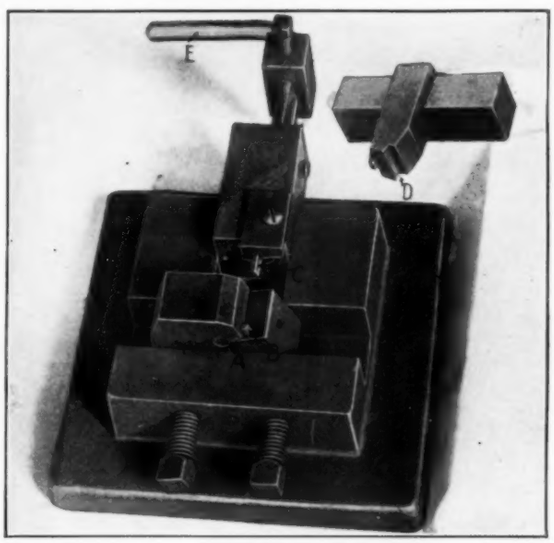

FIG. 5. FOURTH OPERATION—SECOND BEND ON TAIL

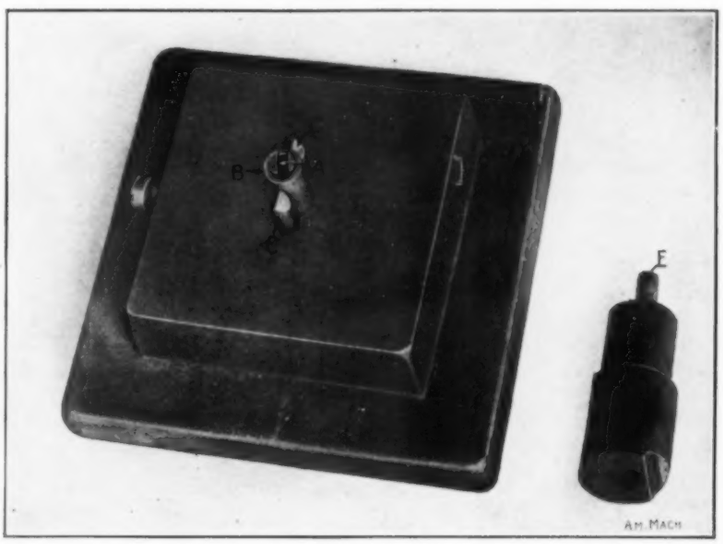

FIG. 6. FIFTH OPERATION—TRIMMING THE TOP

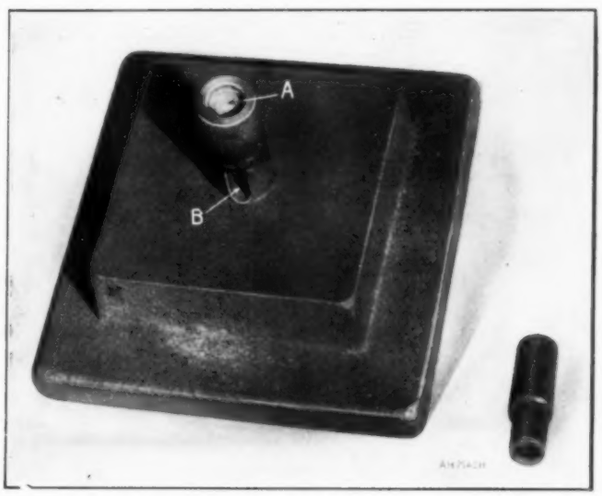

FIG. 7. SIXTH OPERATION—EMBOSSING THE HEAD

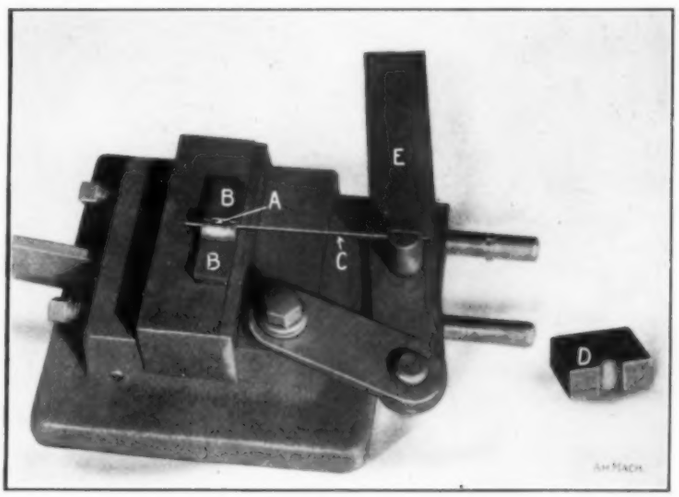

FIG. 8. SEVENTH OPERATION—CURVING THE HEAD

Lubricating with Turpentine

The use of turpentine as a lubricant for drilling hard steel is very general, but I never noticed how very valuable it is until it became necessary to drill some No. 60 holes in spring-tempered steel. Twist drills would not cut at all, so I made three flat drills from drill rod. There was no turpentine in the shop, so I did the best I could running the drill dry or with cutting oil for lubrication.

The results were very unsatisfactory, as the drills required sharpening from four to six times while drilling a hole ⅛ in. deep. Finally the turpentine came and the way the drill ate into that steel was surprising. Twelve holes were finished before the drill needed sharpening and it is safe to say the turpentine raised the production forty times.

Brooklyn, N. Y. F. J. BADGE.

[Half turpentine and half spirits of camphor also make a good cutting compound for hard steel. Nitric acid as a lubricant for turning tempered steel is used by watchcase die makers, but remember that nitric acid is not a nice thing to get into the eyes.—EDITOR.]

Only about 20 per cent. of the industrial plants in this country are electrically equipped, notwithstanding the enormous electrical developments and activities during the past twenty-five years.

The Design of Cast-iron Flywheels*

By F. A. Halsey†

A summary of existing knowledge and practice, with data of direct use in the drawing office.

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†Editor Emeritus, American Machinist.

The stress in a ring revolving about an axis passing through its center due to centrifugal force is similar to that in a boiler shell due to internal pressure and is given, for any material, by the formula.

$$\text{Stress per sq.in. of section lb.} = \frac{\text{weight per cu.in. lb} \times (\text{velocity ft. per sec.})^2}{2.68} \qquad (a)$$

For cast iron having a weight of 0.26 lb. per cu.in. this becomes;

$$\text{Stress per sq.in. section lb.} = 0.097\ (\text{velocity ft. per sec.})^2 \qquad (b)$$

For steel having a weight of 0.28 lb. per cu.in. it becomes;

$$\text{Stress per sq.in. of section lb.} = 0.1045\ (\text{velocity ft. per sec.})^2 \qquad (c)$$

For both iron and steel it becomes, with sufficient accuracy for flywheel calculations;

$$\text{Stress per sq.in. of section lb.} = \frac{(\text{velocity ft. per sec.})^2}{10} \qquad (d)$$

The velocity to be substituted in the formulas is the linear velocity of the center of gravity of the section.

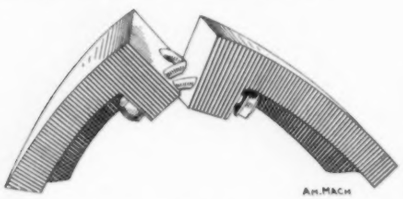


FIG. 1. FLANGED JOINT AFTER BURSTING OF WHEEL

ing may be expected is given, for any material, by the formula.

$$\text{Bursting velocity, ft. per sec.} = 1.64\sqrt{\frac{\left(\text{tensile strength, lb. per sq.in.} \times \text{efficiency of construction}\right)}{\text{weight per cu.in.}}} \qquad (e)$$

For cast iron, taking 19,000 lb. per sq.in. as the tensile strength and 0.26 lb. per cu.in. as the weight, this becomes

$$\text{Bursting velocity, ft. per sec.} = 443\sqrt{\text{efficiency of construction}} \qquad (f)$$

Before the experiments of Prof. C. H. Benjamin (summarized below) were published, the value of unity would have been substituted in this formula for the efficiency of construction of a wheel cast in one piece. Those experiments show this proceedure to be incorrect, such wheels giving way at velocities materially below those to be expected from the

$$\text{Bursting velocity, ft. per sec.} = 757\sqrt{\text{efficiency of construction}} \qquad (g)$$

No experiments have been made on steel wheels to determine their actual efficiencies of construction.

The most essential fact disclosed by these formulas is that the stress increases with the square of the speed, doubling the speed multiplying the stress by four and neutralizing a factor of four based on the stress. Much greater increases of stress are, therefore, possible with flywheels than with steam boilers, and flywheels are correspondingly more dangerous than boilers. The Fidelity and Casualty Co., which insures both boilers and flywheels, finds the hazard on flywheels materially to exceed that on boilers.

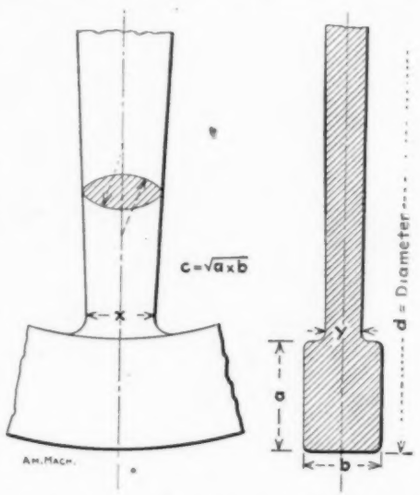


FIG. 2. ARMS OF FLYWHEELS CAST IN ONE PIECE

	1 Solid Wheel 6 Arms	2 Wheel in Halves Flange Joint 6 Arms	3 Wheel in Halves Reinforced Joint 6 Arms	4 Wheel in Halves Link Joint 6 Arms	5 Segmental Wheel Link Joint 8 Segments	6 Rim in Halves Pad Joint 6 Arms	7 Solid Rim with Separate Spider 6 Arms	8 Solid Rim with 24 Tangent Spokes
Rim Speed { Feet per Second	395	194	225	305	256	223	393	424
At Failure { Feet per Minute	23,700	11,640	13,500	18,300	15,360	13,380	23,580	25,440
Apparent Rim Tension at Failure, Lb. per sq.in. by Formula (d)	15,625	3,764	5,062	9,302	6,502	4,973	13,445	17,978
Comparative Rim Speeds at Failure	100	49	57	77	65	56½	100	107
Comparative Rim Tensions at Failure	100	24	32½	60	42	32	99	115
Efficiency of Construction assuming 19000 lb. per sq.in. Tensile strength of Cast Iron	0.85	0.19	0.26½	0.49	0.34	0.26	0.84	0.94

AM. MACH.

TABLE 1. SUMMARY OF PROFESSOR BENJAMIN'S EXPERIMENTS ON THE STRENGTH OF FLYWHEELS

To find the total stress on the section for the calculation of the dimensions of link and other joints, multiply the stress per square inch by the area of the section in square inches.

THE BURSTING VELOCITY

The velocity of the rim at which burst-

tensile strength of the material, the efficiency of the construction being 0.85, though deeper rim sections would probably increase this value. The efficiencies to be substituted for other constructions are given in Table 1.

For steel, taking 60,000 lb. per sq.in. as the tensile strength and 0.28 lb. per cu.in. as the weight, the formula becomes:

LIMITATIONS OF THE FORMULAS

These formulas should be used with caution when designing flywheels, as they are now known to have much less direct application than was formerly supposed.

The condition of simple tension assumed, while true for an ideal revolving ring without arms, is seriously modified by the action of the arms of actual wheels in restraining the free expansion of the rim. Because of this restraint, each rim section between adjacent arms is in the condition of a beam under a uniformly distributed load, the load being the centrifugal force of the material of the section, and the stress due to this beam action is added to the simple tension stress, the resulting stress being always greater than that given by the above formulas.

The beam action is especially serious in the case of built-up wheels with joints located, as usual, half way between the arms. A joint in this position is equivalent to a joint in the middle of a beam and not to a simple splice in a tension member.

The beam action may be reduced by increasing the number of arms. Such increase reduces both the weight and length of the segments and the fiber stress due to the beam action—not the total fiber stress—is hence, other things being equal, inversely as the square of the number of arms.

Prof. Benjamin's Experiments

Attention was first called to this beam action by J. B. Stanwood (*Trans.* A. S. M. E. 1893) and the truth of his analysis has been experimentally proved by Professor Benjamin (*Trans.* A. S. M. E. 1899, 1902) who tested model flywheels to destruction by revolving them in a bomb-proof casing at increasing speeds until they gave way. Fig. 1 shows the manner of failure of the common flanged and bolted joint, located midway between the arms, and demonstrates not only the reality of this beam action but its preponderating importance in wheels of this construction.

It is to be especially noted that in repeated instances wheels with this type of joint gave way through the solid rim and without failure of the bolts, although the strength of the bolts was less than one-third that of the rim section, showing that the strength of this joint, as calculated in the usual way, has nothing to do with the effective strength of the wheel.

The results of these experiments have been corroborated by the experience of the flywheel insurance department of the Fidelity & Casualty Co. which has had several cases of failure of band flywheels with joints of the type shown in Fig. 1, in which the joint section went bodily out of the wheel and—in two cases—without affecting the remainder of the wheel or even bringing it to a stop.

The beam action becomes an increasing factor as the radial dimension of the rim decreases and is at its maximum in thin-rim belt pulleys. Wheels having joints at the point of contrary flexure, that is at one-fourth the distance from one arm to the next, have been repeatedly proposed as better adapted to meet the conditions of the beam action than those placed midway between the arms. Such wheels were tested by Prof. Benjamin and found not to be appreciably stronger than those of the midway joint construction.

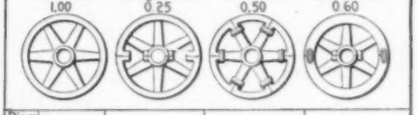
The Experiments Summarized

Professor Benjamin's experiments are summarized in Table 1. The figures of the table are the averages of the experimental results, the number of wheels of each type tested ranging from two to four, except in the case of column 5, of which construction but one was tested.

Regarding the wheel in column 3, Professor Benjamin considers that "If the tie rods had been more carefully designed and constructed, a greater speed could have been attained."

W. H. Boehm, superintendent of the boiler and flywheel insurance department of the Fidelity & Casualty Co., has calculated the very useful Table 2 of safe speeds of cast-iron wheels of various types. The table is figured for a margin of safety, based on speed, of approximately three, or a factor of safety, based on the stress, of nine. The table assumes the solid wheel to have an efficiency of construction of unity, which is not borne out by Professor Benjamin's tests. This company accepts for insurance wheels having a factor of safety on stress of five or a margin of safety on speed of 2.24. It frequently insists on the addition of tie rods (column 3, Table 1) to wheels with bolted flange joints.

Type of Wheels and Maximum obtainable Efficiency of Rim-joint



Diam. in Feet	No Joint 1.00 Rev per Min.	Flange Joint 0.25 Rev. per Min.	Pad Joint 0.50 Rev per Min.	Link Joint 0.60 Rev per Min.
1	1910	955	1350	1480
2.	955	478	675	740
3.	637	318	450	493
4.	478	239	338	370
5.	382	191	270	296
6.	318	159	225	247
7.	273	136	193	212
8.	239	119	169	185
9.	212	106	150	164
10.	191	96	135	148
11.	174	87	123	135
12.	159	80	113	124
13.	147	73	104	114
14.	136	68	96	106
15.	128	64	90	99
16.	120	60	84	92
17.	112	56	79	87
18.	106	53	75	82
19.	100	50	71	78
20.	95	48	68	74
21.	91	46	65	70
22.	87	44	62	67
23.	84	42	59	64
24.	80	40	56	62
25.	76	38	54	59
26.	74	37	52	57
27.	71	35	50	55
28.	68	34	48	53
29.	66	33	47	51
30.	64	32	45	49

If the Revolutions given in the Table be increased 20% the Margin of Safety on Speed will be reduced to two and one half; If the Revolutions be increased 50% the Margin of Safety will be reduced to two

Table 2, by W. H. Boehm, of Safe Speeds for Cast-iron Flywheels. Margin of Safety on Speed Approximately Three. Figures for Pad Joints Do Not Seem to be Justified by Prof. Benjamin's Experiments

Design of Flywheels Cast in One Piece

The flywheel cast in one piece is subject to uncertain initial strains due to shrinkage, but it is, nevertheless, by far the best of all common constructions. This is shown by Professor Benjamin's experiments and is, moreover, shown by common experience in which the failure of such wheels is the rarest of accidents.

In the design of wheels cast in one piece, the uncertainty of the shrinkage strains makes calculations regarding the strength of the arm of more than doubtful value. My own empirical formulas for the arms of such wheels (American Machinist, page 444, April 23, 1896) have been used in the design of wheels from 33 in. to 8 ft. diameter, and have been compared with much larger wheels, with very satisfactory results. The formulas contain a factor for the diameter and another for the cross-section of the rim, together with the usual constant. A rectangular section having its greatest dimension radial is preferred, as it best resists the beam action, but the formulas provide for other sections by considering all sections of the same area as equivalents and taking the side of a square equivalent to the section as the base of the factor for the section.

Referring to Fig. 2 for the notation, the formulas for the arm section at the outer end are:

$$x = 7/8'' + 0.04\,d + 0.153c$$
$$y = \tfrac{1}{2}x$$

all dimensions being in inches. My preference regarding the dimensions a and b is to make

$$b = \tfrac{2}{3}\,a$$

The taper of the arms each side the center line should be from ¼ to ⅜ in. per foot in the side view and ⅛ to $\frac{3}{16}$ in. per foot in the edge view, depending on the size of the hub. The arm section is preferably that made by two arcs of a circle rounded over at the edges, as shown in Fig. 2, such section having a much more pleasing appearance than the more usual ellipse. The arms are usually six in number, but the same formulas may be used for a greater number of arms.

For many cases in which a flywheel is desired but without definite requirements to permit calculations of the section for weight, satisfactory wheels will be obtained by making

$$c = 1\ in. + 0.08\ d.$$

Is a Simple Lathe Impracticable?

By A. L. Pratt

A plea for the building of a simple lathe, which, it is believed, would have four principal advantages over a standard plain lathe. These are: Lower selling price; less wear and cost of upkeep; higher mechanical efficiency; easier to operate.

We all believe in simplicity of design—or we say we do—but why do we not follow that belief to what seems its logical conclusion? The search for simplicity is nearly as widespread, and is very much older than the present-day search for efficiency. But has this search had any particular influence upon machine-tool design and construction? That I personally believe it has not is shown by the title of this article; the question, "Is a Simple Lathe Impracticable?"

There is a just reason for asking this question, for new plain lathes are constantly being designed and put upon the market, as shown by the reading pages of this journal. As none meets my ideas of a simple machine for doing lathe work, that is turning, facing and boring, it is clearly in order to ask, is there anything impractical in the idea itself, or in its execution?

What Is Meant by a Simple Lathe?

By a simple lathe, I mean a machine tool deliberately designed to do the kind of work that ordinarily goes to a lathe 90 per cent. of the time, and nothing else; that is, a single-purpose machine, not an universal one.

Regular or standard machine tools are built to meet a variety of working conditions. This must be so, else they could not be sold. Thus they are universal, or at least adapted to universal conditions. Carrying the thought a step further, the more universal they are, the less are they peculiarly adapted to any one part of the work they are to do. Machines of this type are practical, for they are made, sold, and used in great number. But is there no opportunity, at least in some cases, to get away from this universality, which of necessity introduces so many compromises in design.

Desirable Features in a Simple Lathe

My plea is for a simple lathe. The question is naturally asked, "What would be its principal features?"

At the outset, let us consider some of the things that it is not intended to do, thus getting away from the universal idea. The ordinary lathe is not often called upon to cut threads. We are cutting threads today on turret machinery or in special machines. Therefore, we can completely eliminate the screw-cutting mechanism. Devices for taper turning can follow. A large number of spindle speeds is unnecessary. Nine speeds from a three-step cone with double back-gears will do. With these three changes of feed will be sufficient.

To build up this machine, let us start with a plain heavy bed; and why not cast the headstock integral with it? Turret lathes are commonly made that way.

An editorial recently printed on page 395 pointedly dwells upon the advantages of massiveness in machine parts. Borrowing some of the ideas expressed there, let us use a big spindle. If we are considering a 16-inch lathe, let the spindle be eight or ten inches in diameter.

By the way, for this size, the maximum swing should not be over 16½ inches; that is, a distance of 8¼ inches from the center of the spindle to the nearest point of the shears. The eight inches is one-half of the specified swing—16 inches—and the ¼ inch is a reasonable clearance between a cast surface and a machined one. In use the cast surface is on the work, and the machined surface on the bed. Such an agreement between specified and actual swing would not violate anyone's ideas of an honest specification.

Returning to the spindle detail—let it be of cast iron, hollow of course, but with a thick wall to avoid any tendency to change in shape and to give it weight. Let this spindle be mounted in bearings, each having a length equal to its diameter and each made as a complete ring; that is, without a cap.

To permit of easy assembling and to provide means for taking up, a slot can be milled through one side of each bearing, a liner inserted and the joint pulled together by bolts or screws.

Such a spindle in such bearings, properly adjusted and lubricated, would be practically free from wear.

The thrust bearing could be of any type approved by the designer. Because of its large diameter, the unit pressure would be very low, thus reducing the tendency to wear.

Further, such a spindle in such bearings ought to be practically free from vibration. We are told that vibration is the most destructive action to which cutting tools are subjected. This would make for a higher output as fewer tool sharpenings would be necessary.

I have mentioned the feeds and speeds in a former paragraph. They are such as to call for nothing but the simplest kind of a headstock. The feeds would naturally be belted. But the cones must be of such diameters and face as to provide an ample amount of power for the heaviest work to be done.

The footstock should be as simple as it can be made. The centers should be very large. By the way, does anyone know how centers of high-speed steel act where there is heavy work to be done? Is not the heat-resisting property of high-speed steel a valuable one to use in this place?

The apron has been very much simplified by omitting the lead screw and the rest of the screw-cutting mechanism. As for the feed rod, why not put it in the center of the bed? I have seen it there in a few machines and it seemed to be where it belonged. It is not difficult to provide means to keep it free from chips.

The plain carriage would not undergo much change. A power cross feed is necessary. The rise-and-fall feature of the rest is not needed. The taper attachment can be left off.

Thus in a general way, I have outlined the features of a simple lathe.

Advantages of Such a Design

The next question is, what would be its advantages? I believe there would be four principal ones: (1) A low selling price, perhaps not more than two-thirds of the present price of a plain lathe of the same capacity. (2) Wear and repairs reduced to a minimum through the simplified mechanism and rugged construction. (3) High mechanical efficiency for the reason given under (2) above. (4) Ease of operation, an important point where unskilled labor must be taught and used on machine work.

These four reasons are sound and represent real advantages to the lathe buyer and user. They at once answer my opening question, as to the practicability of a simple lathe, at least from the mechanical viewpoint. If there is still any impracticability it must come from commercial reasons.

Having carried my argument thus far, may I go a step further and express the hope that someone will design and build such a machine and give it a thorough, fair trial? I am convinced that it would be a mechanical and engineering success. Of the commercial side I am not in a position to judge. Let us hope that one of these days the American Machinist will print a description of the design, test and working-producing record of such a simple lathe.

For small, round perforating punches, piano wire used without hardening or tempering, but with the ends that go into the holder drawn so as to permit upsetting, is said to have initial economy and long service in its favor.

Upkeep of Shop Lighting Systems*

By C. E. Clewell†

This article includes among other points certain items related to electrical circuits; economy in the use of carbons for arc lamps; methods of inspecting the lighting systems and methods of cleaning globes and reflectors.

These items will not cover the entire question of upkeep but are intended to indicate some of the problems involved as well as to furnish some hints for aiding the maintenance departments in both the small as well as the large shop.

A recent editorial in one of the current periodicals contained, in substance, the following:

The present strong tendency toward the introduction of various plans for increasing industrial efficiency is sure to be shown in improved artificial illumination. Indeed, there is some reason to hope that the desire for higher efficiency may bring about a great improvement in shop lighting irrespective of legal requirements. There is more activity in good shop lighting in this country than in any other phase of illuminating engineering, and the results justify the expenditure. We have yet to learn of any industrial plant, the management of which has regretted its expenditure for good natural or artificial light.

The foregoing statement indicates a growing tendency toward improved illumination in shop work, and with the attendant betterment of both old and new shop-lighting systems will come the equally important necessity for a careful regard to efficient upkeep.

The artificial lighting of the shop may be classed under three heads as follows: The design or preliminary plans; the installation based on the plans; the upkeep.

The shop manager with an interest in this phase of his equipment may naturally concentrate attention on improvements in the preliminary plans when contemplating better lighting systems, and on the methods of installing, but due regard should also be given to the important fact that the lighting system, like all other shop equipment, will lose much of its value without a systematic care for the upkeep.

*This is the seventh of a series of articles on shop lighting being written by Mr. Clewell for the American Machinist. There have already appeared in Volume 34: "Machine Shop Lighting," page 595; "Drafting Room Lighting Problems," page 686, and "Foundry Lighting Problems," page 1076; in Volume 35: "Shop Lighting Design," page 346, and "Shop Lighting Installation," page 777; and in Volume 36: "The Artificial Lighting of Machines," page 127.—Editor.

†Lighting expert, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

System Is Essential

The importance of system in the upkeep of a lighting installation may not appeal to every reader. Carbon-filament and tungsten lamps burn out, globes and reflectors become soiled, and the various other items of deterioration take place so gradually that in many cases they are given no special concern in the practical economy of the shop. Moreover, it is hardly necessary to mention the fact that often the lighting systems are allowed to depreciate to an extreme point and nothing is done unless complaints come in from the employees after the lighting facilities here and there throughout the shop have become too poor to permit of a continuance of work. The losses of time, when integrated throughout the year from such circumstances, are more than likely to exceed the expense of systematic attention.

Furthermore, with the more modern methods wherein the lamps are usually mounted overhead rather than close to each machine, the importance of relieving the workmen from any care of the lamps is even greater than in the past. To indicate the wisdom of a daily renewal of electric lamps, Fig. 1 has been worked up from experience in one large shop. In this shop all burned-out lamps are renewed each day, except Saturday and Sunday, this renewal being based on a daily inspection of every lamp to ascertain whether or not it is in working condition.

A reference to the diagram shows that the renewals are considerably greater on Monday than on any other day of the week, this increase being due to renewals not given attention on the two preceding days. Obviously, therefore, a continued neglect of the inspection and renewal of these lamps would soon result not only in inferior lighting conditions, but loss of time to employees, and much annoyance.

The serious loss of light when globes and reflectors are allowed to go for long periods without cleaning, is shown in Fig. 2. This set of curves resulted from a test on a glass reflector (commonly called a shade) used with a tungsten lamp. The one curve shows the value of the light given by the lamp at different angles when the lamp and reflector are clean, while the smaller curve shows the enormous reduction of light after the lamp and reflector had been in service for about four months without being cleaned.

In this particular case, which is a typical one, the loss of light at the end of the four months amounted to nearly 50 per cent. The cost of electrical energy in the shop where this test was made was such that the loss of light during the four months amounted to about 12 cents, while the total cost of taking down, washing and replacing this reflector amounted to about 3 cents, os that the economy of a fairly frequent attention to the cleaning of such reflectors, even if the improved condition of the light in itself be ignored, is at once apparent.

The examples just given, in the one case associated with the renewal of lamps, and in the other with the wash-

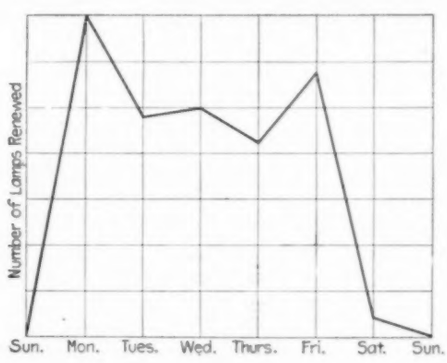


FIG. 1. THE FLUCTUATIONS IN DAILY RENEWALS

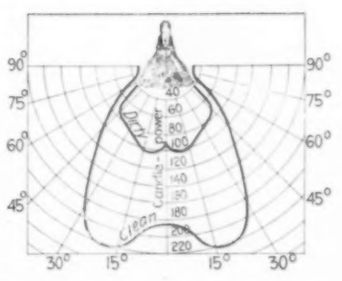


FIG. 2. CURVES SHOWING SERVICE LOSSES OF LIGHT DUE TO DIRT

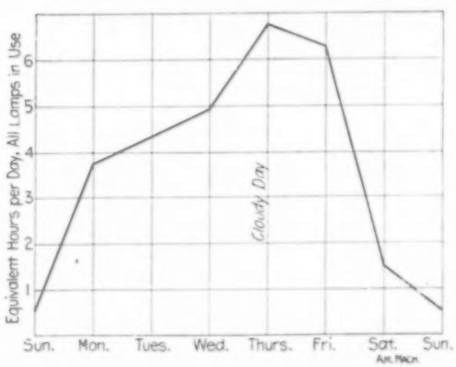


FIG. 3. THE FLUCTUATION IN THE LIGHTING LOAD

ing of glass auxiliary apparatus, will serve to illustrate the class of upkeep problems which are involved in shop lighting; and the most forcible emphasis is therefore applicable to the idea that *system* may properly be called the first step toward success in this work.

Adequate Electrical Circuits

Electric lamps are most advantageously operated on circuits free from variations in voltage or pressure. To this end the circuits should not be used for both motor and lighting purposes. Shop motors, elevators, ventilating fans and the like when supplied with power from the same circuits used for the lamps are usually so variable in their demands that great variations of voltage on the lamps are likely to result. Separate circuits for lamps and motors are, therefore, highly desirable.

Fig. 4. Truck for Hauling Glass Reflectors

Electric lamps furnishing more light for the same power are now available, as compared with a few years ago. The use of more highly efficient lamps may naturally be associated with a saving of energy, and in many cases would so result were it not for the fact that in many old lighting systems the quantity of light is so inadequate that an equal amount of power, or even more, will be required with new lamps in comparison with older types, in order to insure the necessary increase of illumination.

For the foregoing reasons care should be exercised to see that the supply circuits have a sufficient capacity, and from the standpoint of upkeep they should be augmented from time to time as new equipment is added, so that wide variations in the lamps used may be possible without an appreciable variation in the voltage. Fig. 3 shows the great variation in current used from day to day throughout a typical week, due to the varying usage of lamps on different days.

Methods of Inspection

In one large shop a regularly developed method of inspection and renewals is employed. As an example, the method as applied to several thousand tungsten lamps, which are in service in the various buildings, will be described. All the lamps are inspected once per day, except on Saturday and Sunday. A regular route is followed by the inspector, and all burned-out lamps, broken switches, loose fuses and the like, are noted. Careful observation is also made of reflectors which appear to need washing and any other items which affect the efficiency of the lighting system, after which a report is made up about noon and promptly sent to the maintenance department to permit all renewals and repairs being made before night. In this manner the lamps are well maintained from day to day.

To facilitate this renewal work, it has been found advantageous to mark all columns throughout this shop. The inspector is thus enabled to indicate clearly the location of each burned-out lamp and the renewal man to locate it without delay. It is helpful now and then in like manner to have the inspector note the unnecessary burning of lamps when artificial light is not required. If lamps are found burning at such times, a note sent to the head of the department, calling attention to the matter, is usually sufficient to remedy the difficulty.

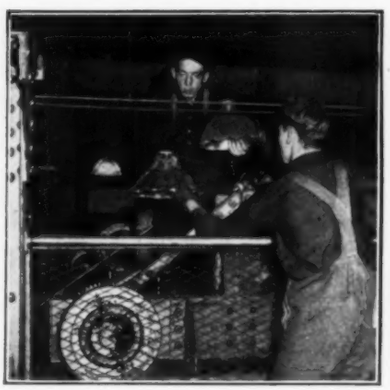


Fig. 5. Exchanging Soiled for Clean Reflectors

Methods of Cleaning

As a check on a regular schedule, the inspector should note all reflectors in need of cleaning. The frequency of such cleaning will obviously depend on the rate of deterioration due to the settlement of dirt on the surface of the glass or metal, and the fact should be kept in mind that the amount of dirt on a reflector is always deceiving; that is, reflectors which have suffered a large depreciation in efficiency due to dirt often appear fairly clean, and for this reason it is best to increase the frequency of cleaning somewhat over that which seems sufficient from observation, particularly in view of the fact that tests indicate large reductions of light from apparently small accumulations of dust and dirt.

In the shop before referred to, all reflectors are removed to a central washing point. Where the number of reflectors to be hauled is large, a truck, as shown in Fig. 4, is used. Often, however, where only a small number of reflectors is to be transported, small hand racks, devised for the purpose, are used. When an installation is in need of washing, the scheme is to haul sufficient clean reflectors to the location in question. The soiled reflectors are then taken down and clean ones immediately put into place, after which the soiled reflectors are removed to a central point, washed and put into stock for the next location.

The method of exchanging a soiled for a clean reflector from a ladder is also shown in Fig. 4. Fig. 5 shows the method of exchanging reflectors from the top of a crane. In this case the one man is 20 ft. above the floor, while the clean reflector is being handed out from an adjoining mezzanine floor. This method of doing all the work at one central washing point rather than at various locations throughout the shops, is the result of experience, and the use of hot water and soap has been found to answer every ordinary purpose. Glass reflectors thus cleansed present a luster almost equal to the appearance when new, and the results on the lighting system will be found well worth the effort and expense.

Fig. 6. Washing the Globes and Reflectors

The method of washing is seen in Fig. 6. The trough at the center holds the hot water. The soiled reflectors are placed at the right, and after being washed and rinsed, are placed on the drain board at the left, ready to be dried and placed in stock.

Reducing Arc-lamp Carbon Waste

An interesting scheme is employed in one shop to reduce the waste of arc-lamp

carbons, due to the tendency of the trimmer to remove some of the carbons from lamps before they have been fully consumed. This shop, being very large, employs a number of lamp trimmers, for each of whom a tin box is provided. When the trimmer starts on his rounds, one of these boxes, filled with new carbons, is supplied by the storeroom, and with thus slung over his shoulder, the trimmer makes his rounds, substituting new carbons in the lamps for those nearly consumed, and placing the short, partially consumed carbons in this holder or box.

On reaching the lamp department, this tin box, filled with only a few new carbons and the remnants of the used carbons removed from the lamps, is turned into the storeroom. The short pieces of used carbons are emptied into a tray, one tray being employed for each trimmer, and the foreman, after inspecting the trays each day, is enabled to detect any carelessness on the part of the trimmers, in trimming lamps before they actually require attention.

Conclusions

In the foregoing an effort has been made to draw attention to some of the items involved in the maintenance of shop-lighting systems at high continuous efficiency. Viewed from the standpoint of economy alone, the expense is justified. When to economy is added the comfort and assistance that such a well regulated system imparts to employees, the matter becomes doubly important. Many shops have found the outlay for lighting upkeep more than compensated for by better illumination, more contented employees and a shop cheerful in a degree commensurate with the outlay made for new lighting equipment.

Riveting Dies

By A. C. Claire

The straight rivet and the headed rivet are most used in the average work.

A die for riveting three gears together, the central gear *A* to the two outside gears *B* and *C*, is shown in Fig. 1.

The straight-pin rivet, which is but a piece of wire cut to the proper length, is upset on both ends at the same time into the flange of the gear *B* on one side and into the flange of the gear *C* on the other side.

The punch *E* has a stem *S* fitting into the press slide. It is made of tool steel and so formed that its face fits into the flange in the gear *B*. The die is secured in a sliding cast-iron holder *H*, which slides between the pieces *L* secured to the bolster plate of the press. The die *F* fits into the die holder *H* and is removed by means of the handles *G*.

In order that the rivet *D*, which is normally straight, shall rest in the proper position to upset on both ends at the same time when the press operates, there is a button *I*, which slides in the die *F* and fits into the bore of the gears *C*, *A* and *B*. This button is held in its normal position by means of a rubber cushion *J*, the pressure of which is governed by the headless screw *K*.

The operation of the die is as follows: First, the die is drawn out from under the punch and the gears *C*, *A* and *B* are placed on the button *I* of the die *F*, which holds the gears above the surface of the die far enough to allow for the upset of rivets *D*. Then the rivets are put in place and the die slid under the punch and locked. When the punch comes down we find the three gears *C*, *A* and *B* with the rivets *D* in such a position that they project equally into the flanges of the gears *B* and *C*.

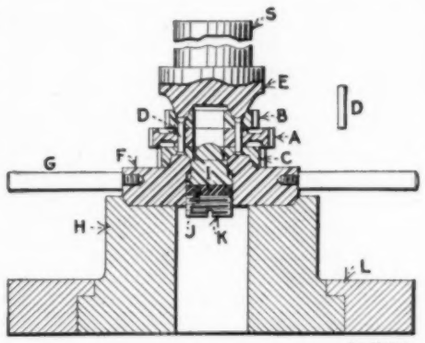


Fig. 1. Riveting Die with Straight Pin Rivets

Therefore, whatever pressure is exerted by the punch *E* upon the rivets *D* the result must necessarily upset the straight rivets *D* equally on both ends and expand both ends into the flange of the gears *C* and *B*.

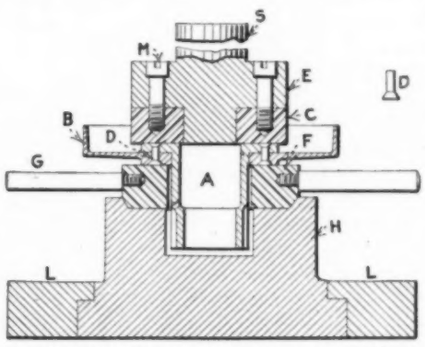


Fig. 2. Die for Riveting One End of Headed Rivets

In Fig. 2 is shown a die for the other type of headed rivets where it is only necessary to upset or rivet one end.

This die consists of a punch holder *E* of cast iron with a stem *S* fitting into the press slide. This punch has a steel ring *C* secured to the holder *E* by screws *M*. The die consists of a cast-iron holder *H*, which slides between the pieces *L* screwed to the bolster plate of the press. The die itself *F* is made of tool steel fitted into the die holder *H* and made removable by means of the handles *G*.

In operation the die *H* is drawn out and the drum *B* and gear *A* are placed into the die *F* with the rivets *D* in position, head down, so that the ends of the rivets *D* project above the flange of gear *A*. The die is then slid under the punch *E* and made fast so that when the punch *E* descends the whole pressure of the slide is exerted upon the upper end of the rivets *D*, which are forced into the countersunk holes in *A*.

An Apprentice Boss

By J. Kempt

An intervening holiday found our small shop congested with work, a scarcity of hands and a job for immediate delivery on the books. The boss in discussing this with the foreman said that he would run the press after looking over the mail. He appeared later and started the press and soon things began to hum.

Some of the work was sent upstairs for the next operation. Presently "Eddie," the operator, came down with an armful of the boss' work. Passing it over to the foreman he said:

"Look at these."

"Why Eddie," says the foreman, "they are wrong! Guess that new boy of yours is not attending to his work. He's forming the stock wrong side out. Go over and show him."

Approaching the boss, Eddie said:

"Look here, young fellow, your mind's not on the job. Here you're wasting a lot of time and material and the boss wants this order shipped today, Can't stand this kind of thing, you know. Whatcher mean by it?"

Taking the pieces from Eddie, the boss looked them over and his face broke into a broad smile. Says he:

"Eddie, that's one on me all right. Here, take this dollar bill and lose yourself. Buy yourself a house. Get out some more strips first, and I'll try to be good."

Eddie pocketed the bill with a smile that was soon communicated to the whole force. The boss' sense of humor and graceful acknowledgment of his mistake had a generally stimulating effect and the work was delivered as promised.

In the acetylene-burning lighthouses along the Panama Canal will be installed copper cylinders exposed to the sun. When the sun rises in the morning and the rays fall upon these cylinders they will expand and close valves that admit gas to the burners. As night approaches and the sun's rays diminish in power, the cylinders will contract and again turn on the gas, which will be ignited by small pilot jets.

Scientific Management—A Suggestion

By George F. Card*

The first step in a system to secure greater segregation and close record of individual machine performances.

*Production manager, Fort Wayne Electric Works.

I have read with much interest the views of John Calder, manager of the Remington Typewriter Works, on "The Economic Administration of Industrial Establishments." In this article Mr. Calder refers to "Scientific Management," and gives Mr. Taylor full credit for painstaking investigation, but while he "believes thoroughly in the principles enunciated by Mr. Taylor, he is of the opinion that they are offered for application in a detailed system too complicated, too rigid and too unyielding for immediate application to everyday needs."

Many manufacturers take the same view, and while the trend is inevitably toward a higher plane of efficiency, which must ultimately compel the introduction of many refinements, there will be many who will hesitate, perhaps to their future embarrassment, because of the long time it takes to get results and the cost.

In view of this attitude toward Mr. Taylor's rather complex system, it might not be out of place to suggest another method applicable to certain lines of manufacture. While this method may not be so complete and effective, it is, nevertheless, planned on similar lines, and has the inducement of full recompense for all outlay and effort within reasonable time.

This trial method must of necessity be susceptible of application without disturbing the customary routine. Then, if not found satisfactory, the work can revert to the old order without friction, while if satisfactory it will become an integral part of the new system and an important factor in eliminating wasted time and effort.

Time Lost on Machines

Perhaps there is no one thing about a factory better known to superintendents and managers than the fact that many of the hours constituting a day's work are wasted in various ways, and that machine tools seldom realize, even approximately, their estimated output. Recording wattmeters tell this conclusively, and ammeters in motor-driven factories, give further visual evidence. Spasmodic efforts are often made to correct this trouble, but never with complete or permanent success, because the methods employed do not reach the prime cause of the loss—the machine operator.

Then why not make the elimination of this loss the initiative step in a trial effort for higher general efficiency? It is logical, and there can be no rational objection to the mere requirement that employees occupy their full working time doing the kind of work they are paid for. If ten hours is the working day, and a machine runs only seven, eight or nine hours, a full day's work is not accomplished, although it may not be altogether the operator's fault that this loss occurs. Lax methods of handling shop details and material may cause a large part of it; but the fact remains, that much of the customary late starting and early stopping of machine tools for each half-day's work is wholly unnecessary, and constitutes a loss of considerable proportions. The amount of this loss varies in different factories, but the careful estimate of experts made in a number of cases, gives figures truly startling. Enough, even after a most liberal discounting, to make a prosperous concern uneasy.

One published report of an investigation of this kind makes the loss $106 per year for each employee, in time, output and cost. Other reports, while running a little lower, are close enough to prove it approximately correct, factory conditions and the number of men employed slightly affecting the result. All these investigations were made in the most careful manner, by experts, and so far as the writer knows have not been refuted. One hundred dollars per hand in a factory employing 500 people is $50,000, an amount instantly rejected as unreasonable and untrue by anyone who has not given the matter consideration. When reduced to a per diem basis, however, the figure does not seem so appalling, for 33⅓c. is an amount, it must be admitted, that the poorest paid helper in any shop might soldier away without detection. Taking $75 per year as a safe, conservative estimate of this loss, which is only 25c. per day per hand, we still have the neat little sum of $37,500 for a year of 300 working days to think about; also the fact that this loss occurs during the starting and stopping periods for each half day, and does not include the wasted time during the intermediate hours.

Locating and Profiting by the Loss

Taking indicator cards and records from wattmeters and watching ammeters can do little more than locate the loss, because these methods cover the whole or a large section of the factory. The problem of profiting from the information thus obtained must of necessity be put up to the foremen, who find it an onerous task, which they soon tire of, and so things slowly but surely drift back into former conditions.

Admitting this loss and that it is common to all factories, also that the money value of it runs into figures well worth an effort to save, it would seem that all that is needed to change a lot of these wasted hours and minutes into hours and minutes of activity and profit, is greater segregation and the getting down to individual machine performance. This means, of course, a daily record from every machine or at least from all machines used regularly for production.

This requires a device to automatically make a record of each machine, and located beyond the control and influence of foreman or operator. Obviously such a device must be operated electrically and must embody features specially adapted for this service. In the first place, it must be inexpensive and should not exceed $5 in cost. It must make a close and correct record of the machine's performance, which cannot be done in less space than about ⅛ in. per min., or 22½ in. per hour, making 18¾ ft. for a day of ten hours.

It must, furthermore, be so constructed that the total running time of the machine it is connected to can be read off any time during the day, and should have some simple arrangement for automatically starting the record in the morning, and for marking this time on the chart, or ribbon, so that no injustice is done to the workmen. The electric energy to operate it should not be more than is required for a 16 cp. incandescent lamp, and the style and cost of wiring, the same as for that class of work. It should be neat and durable in construction, reliable in action and so easily cared for that a girl of ordinary ability might operate it. Given such an instrument, and a machine to connect it to, we have the simple unit of a system that can be extended at pleasure to cover large or small shops and all kinds of power-driven machinery.

Mechanical Causes of Low Efficiency

We have selected a loss that we want to stop, and tentatively an instrument that we think will help us do it. In the beginning of operations there need be no change from the usual way of doing things. The machinist goes about his work as usual, and the recorder jots down what he is doing. Nothing more need be done to bring about a surprising change. The moral effect alone of knowing that every start and stop of his machine is

indelibly written on a piece of paper, which may reach the superintendent, will stimulate him to greater exertion and diligence in the performance of his work.

But presently, as the experiment goes on, it is discovered that the workman is not wholly to blame for the low efficiency of his machine. Admittedly he is now doing his best, but still his running time is only 40 or 50 per cent. of the total, and in self-defense he has submitted a bill of particulars that starts investigation in another direction. This soon proves that there is more in his complaints than a lazy man's excuse. Here are a few you will readily recognize:

A loose belt that had to be shortened or replaced during working hours; poor or insufficient tools that took a half hour or more to make, look up or sharpen; insufficient material on hand to keep going steadily, causing a loss of time waiting, or compelling a change to another job; inadequate facilities about the machine for receiving material and disposing of finished work; time lost preparing material for the machine that could and should have been done by someone else.

And so, as the investigation proceeds, other losses are uncovered, inconsiderable in themselves, but aggregating a total that may, at the end of the year, spell a profit or loss.

The process of taking care of these things will work automatically and become compulsory in so simple a manner it hardly needs explaining. Before the instrument was used the machine was doing a certain amount of work and the operator was paid a certain amount of money for running it. Presumably this arrangement was satisfactory to the office.

Along comes this instrument, and in a quiet, unobtrusive way uncovers a lot of wasted time that the superintendent cannot approve, and for which his manager expects him to find a remedy. It stands out amazingly until, finally, from pride in his work or fear of censure, he is compelled to do something. Then comes an analysis of the wasted periods, with changes here and there to save time and simplify operations.

Lost time during the day can be handled in the same way that late starting and early stopping is, and gradually, as defects are discovered, steps can be taken to correct them. In this way working from the machine operators, who are usually the highest priced and most intelligent men in the factory, all minor details about the place are taken care of, and the routine of production is finally developed into one of highest efficiency and adaptability.

This system has the inducement of small initial cost and immediate returns, and lends itself readily to existing conditions in any shop using power-driven machinery. It makes it possible to gradually change the old wasteful idle ways into effort and profit, without friction or disturbance to current business.

Separate Pattern Maker's and Shop Drawings

EDITORIAL CORRESPONDENCE

The advantages of a shop drawing that does not have the pattern dimensions, has been frequently pointed out. However, we seldom find a shop that deliberately prepares separate drawings for the pattern shop and machine shop. The added expense of duplicating a given drawing is usually considered greater than the possible resulting advantage. A contrast to this usual rule is the Kempsmith Manufacturing Co., of Milwaukee, Wis.

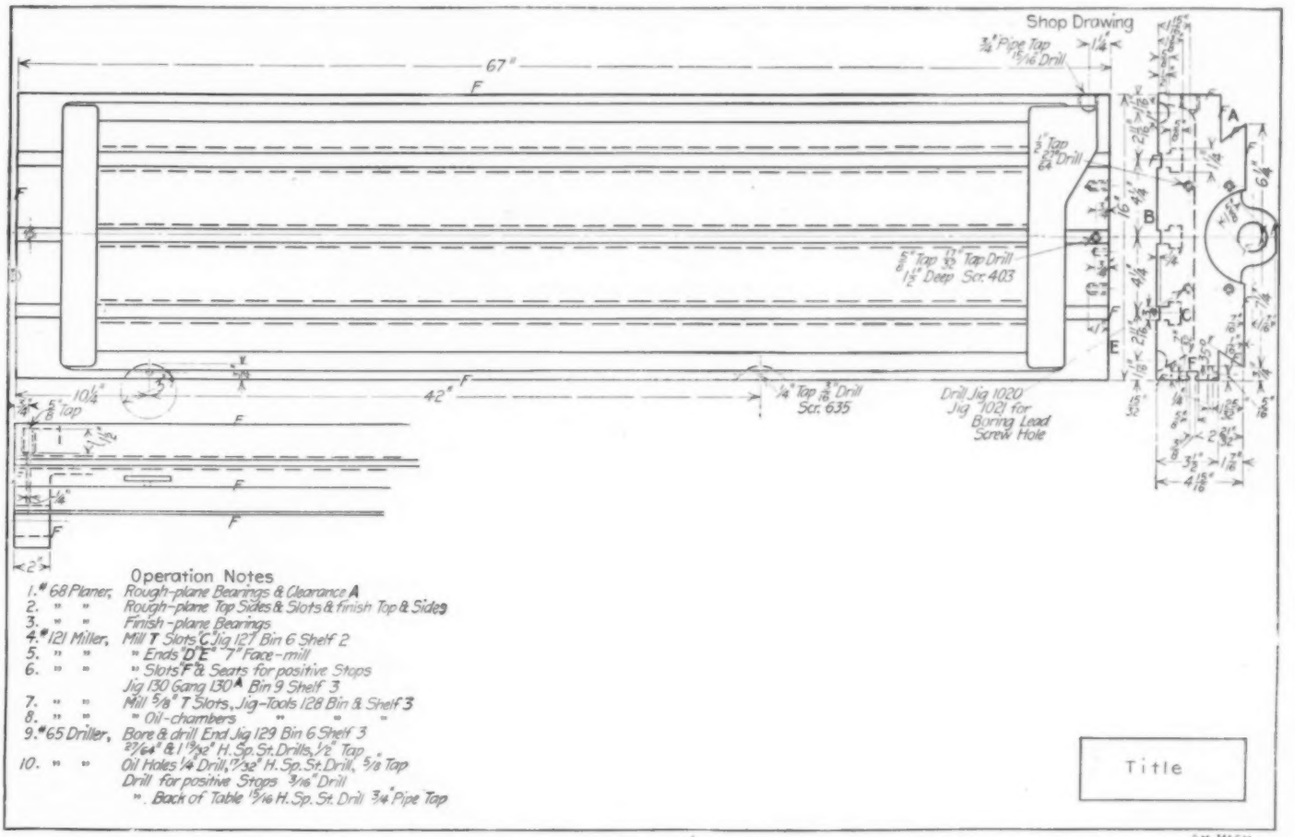

Shop Drawing
67"
42"
Operation Notes
1. #68 Planer, Rough-plane Bearings & Clearance A
2. " " Rough-plane Top Sides & Slots & finish Top & Sides
3. " " Finish-plane Bearings
4. #121 Miller, Mill T Slots C Jig 127 Bin 6 Shelf 2
5. " " " Ends D E 7" Face-mill
6. " " " Slots F & Seats for positive Stops Jig 130 Gang 130A Bin 9 Shelf 3
7. " " Mill 5/8" T Slots, Jig-Tools 128 Bin 8 Shelf 3
8. " " " Oil-chambers " " "
9. #65 Driller, Bore & drill End Jig 129 Bin 6 Shelf 3 23/64" & 1 13/32" H. Sp. St. Drills, 1/2" Tap
10. " " Oil Holes 1/4" Drill, 17/32" H. Sp. St. Drill, 5/8" Tap Drill for positive Stops 3/16" Drill " Back of Table 15/16 H. Sp. St. Drill 3/4" Pipe Tap
Drill Jig 1020 Jig 1021 for Boring Lead Screw Hole
Title
AM. MACH.

FIG. 1. DETAIL SHOP DRAWING OF MILLER TABLE

For their cast parts, two drawings are sent out; the one for the pattern shop and the other for the machine shop. An ingenious and successful method has been worked out whereby the additional work required to make the pattern maker's drawing from the shop drawing is very little.

The starting point is the fact that the pattern maker needs practically all of the machine-shop dimensions, in addition to those which apply exclusively to the pattern itself. Thus the machine-shop drawing is made in the usual way, except that

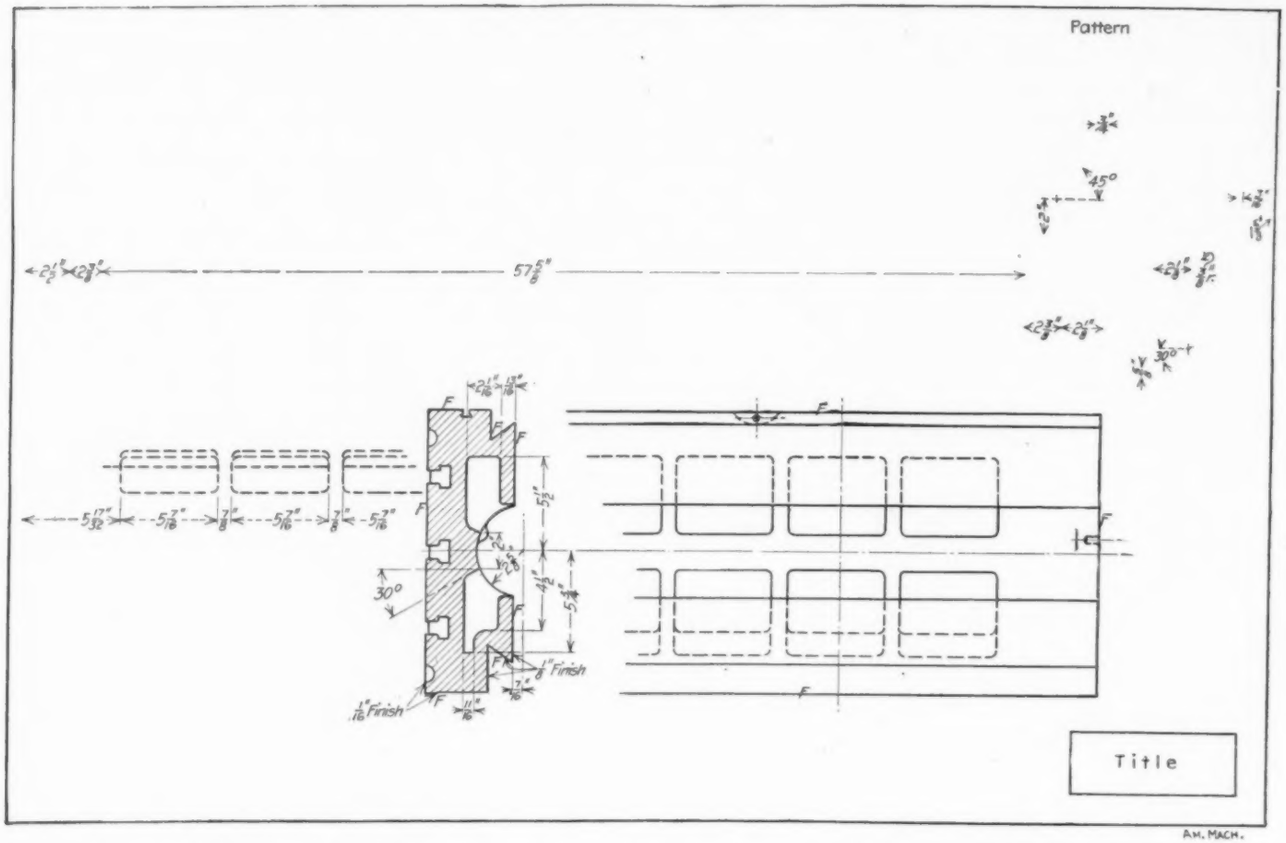


FIG. 2. ADDITIONS TO DETAIL SHOP DRAWING TO MAKE PATTERN MAKER'S DRAWING OF MILLER TABLE

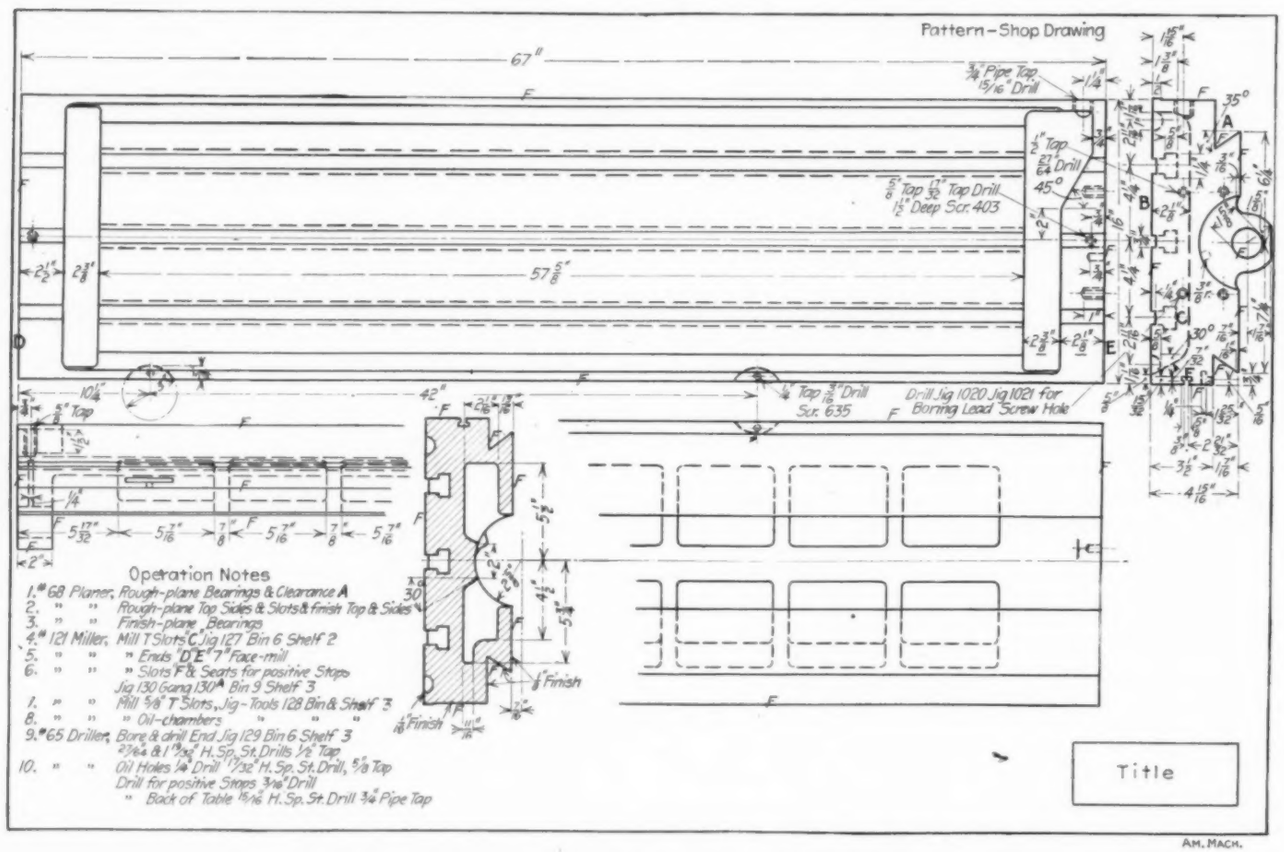

Pattern – Shop Drawing
67"
57 5/8"
42"
45°
30°
35°
Operation Notes
1. # 68 Planer, Rough-plane Bearings & Clearance A
2. " " Rough-plane Top Sides & Slots & finish Top & Sides
3. " " Finish-plane Bearings
4. # 121 Miller, Mill T Slots 'C' Jig 127 Bin 6 Shelf 2
5. " " " Ends 'D' 'E' 7" Face-mill
6. " " " Slots 'F' & Seats for positive Stops
Jig 130 Gang 130A Bin 9 Shelf 3
7. " " Mill 5/8" T Slots, Jig-Tools 128 Bin & Shelf 3
8. " " " Oil-chambers " " "
9. # 65 Driller, Bore & drill End Jig 129 Bin 6 Shelf 3
27/64 & 1 9/32" H. Sp. St. Drills 1/2" Tap
10. " " Oil Holes 1/4" Drill 17/32" H. Sp. St. Drill, 5/8 Top
Drill for positive Stops 3/16" Drill
" Back of Table 15/16" H. Sp. St. Drill 3/4" Pipe Tap
Title
AM. MACH.

FIG. 3. PATTERN MAKER'S DRAWING OF MILLER TABLE

the coring is not shown on the outline. It is fully dimensioned and has the necessary operation notes. This drawing is made on a piece of tracing cloth, double the size required. This piece of cloth is then folded once, to give in effect two facing pages of a book.

The machine-shop drawing is on the under page and faces upward. The additions needed by the pattern maker are now drawn on the uppermost half of the tracing cloth in register with the machine-shop drawing below, and, of course, facing upward.

The drawing for the pattern shop is now printed from these two superimposed drawings, while only one-half of the entire drawing, that is the part having the dimension to which the casting is to be finished, is printed for the shop.

This method is far simpler in use than in description, as will be seen by referring to Figs. 1, 2 and 3. Fig. 1 shows a detailed shop drawing for a miller table. Fig. 2 hows the additions that are made to this detailed shop drawing, to fit it for the pattern maker's use. The combined drawing or complete pattern-maker's drawing, is shown in Fig. 3.

These three drawings, in addition to showing the method by which they are made and printed, serve as an excellent example of the degree to which a shop drawing is simplified by leaving off the information needed only by the pattern maker. Fig. 1 is seen to be much simpler and more easily read than Fig. 3. This simplification must bring about a direct saving in time on the part of the workman. Instructions for doing work cannot be made too plain.

On the other hand, the additional information needed by the pattern maker is not very great in itself, as shown by Fig. 2. Thus the time required in making the pattern drawing, is not a large item for an ordinary piece. This method of producing separate drawings for the pattern and machine shops eliminates, or at least minimizes, the usual objections to making two drawings for cast parts.

A Die for Wiring Pails

By M. Martin

The difficulties encountered with a defective die for wiring pails made of very thin stock and the way in which these difficulties were overcome.

A concern that decided to go into the extensive manufacture of the ordinary iron bucket or pail, taper or flaring pattern, ordered several sets of dies from a well known concern that specialized along these lines.

From the very start all kinds of trouble was experienced with the wiring, which was a press operation and consisted of picking up a circular wire that was formed to fit around the top end of the pail body, by curling that part of the body around it.

The manner in which this die was constructed, resulted in a loss by defective and spoiled material of anywhere from 12 to 40 per cent., which was absolutely prohibitive considering the narrow margin of profit. This trouble consisted of two distinct features: The failure of the material to curl and properly pick up the wire, and the crumpling of the pail body at the top.

In Fig. 1 is the pail body, showing how the top is curled about the wire. This body is in two sections grooved together, and is made of from 28 to 32 gage "black" stock suitable for galvanizing. The bottom of the pail has not been attached as it would interfere with the wiring. Fig. 2 is the pail body not wired and in the original shape after the two sections have been grooved and ready to be wired in the die.

The circular wire which is cut off and curled in an ordinary wire-forming machine, the two ends of which are left loose, is shown in Fig. 3. This wire is intended to strengthen the top of the pail. Fig. 4 shows the upper part of the die as received from the maker, and is constructed as follows: *A* is the cast-iron die pot secured to a proper bolster as shown in Fig. 7. It is machined on the inside to the same taper as the pail to be wired, and large enough to allow the pail body to stand on its base.

The upper part is recessed for a steel wiring ring *B* which is held up against the clamps *D* by springs placed in the pockets *C*. This ring is also machined to conform to the taper of the pail body when it is in position against the clamps *D*, and is so placed to allow the pail body to project sufficiently to enable the wire ring, Fig. 3, to be placed around it. The travel of this curling or wiring ring is shown by *E*, and *F* is the top of the ring and die at the completion of the operation.

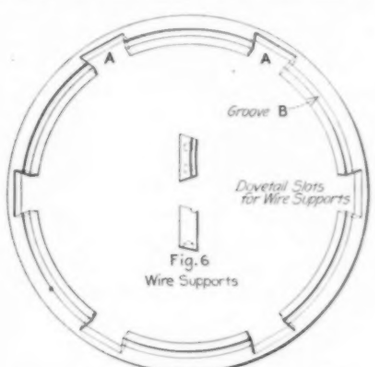


Fig. 6 Wire Supports

Fig. 5 Steel Ring

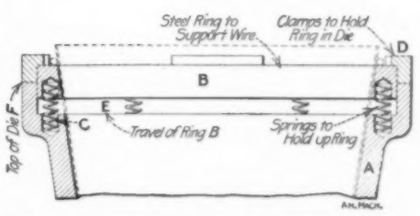


FIG. 4. UPPER PART OF ORIGINAL DIE POT

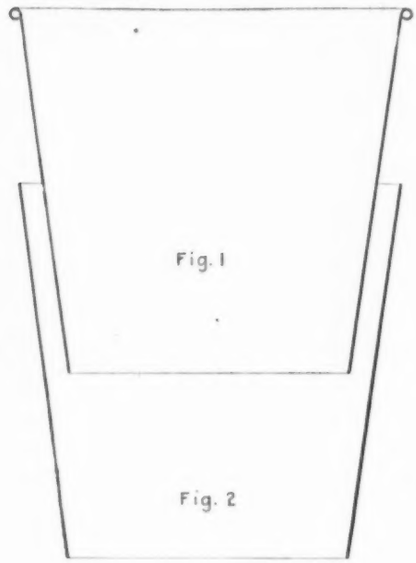
This is where the principal defect in operation occurred. To enable the pail body to stand on its own base with this ring up against the clamps, made it imperative that it be machined, as before explained, to the size of the bucket at this point, and consequently in the perpendicular downward movement of this ring when wiring the support for the tapered body of the pail was removed from the outside and the stock was likely to crumple. In the lighter gages of metal it was almost impossible to make a perfect pail on account of this.

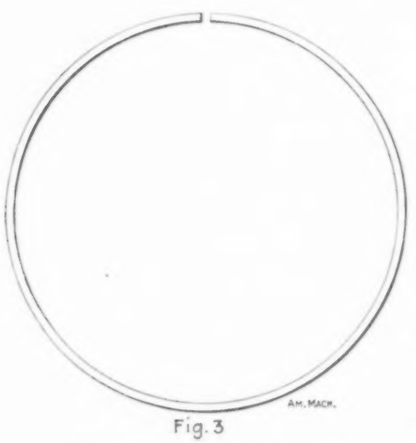
With relation to the second defect: The top of this ring was machined absolutely flat and had no groove at the wiring point to help hold the wire in place and to "hug" the body to insure a proper pickup and curl. This resulted in the wire being pushed away from the body at times and jamming between the punch and the die, thus almost wrecking the press. This happened repeatedly even though great care was taken to have the wire formed as nearly round and flat as possible, and somewhat smaller in diameter, so that there would be spring to it, encouraging it to hug the body. As the punch descended and forced the metal around it, it would contract with the decreased diameter in following the taper of the body.

The method adopted to overcome these two defects was of a simple nature, yet the improvement was so great that there was less than one-half per cent. in defective material. This was accomplished as follows:

The upper part of the original die pot *A* in Fig. 4 was machined somewhat deeper so that the new steel ring, Fig. 5, was secured to it by screws through the wall.

This ring, Fig. 5, was machined on the inside to conform to the taper of the pot and was also flat on top, but had a groove *B* right up close to the taper edge and equal to one-half of a circle, the diameter of the combined thicknesses of the stock and the wire. Six dovetailed slots *A* of sufficient width and depth were cut into this ring parallel to the taper of the inside, and were intended for the





THE PAIL BODY AND WIRE

wire supports or sliding blocks as shown in Fig. 6, which were a nice sliding fit.

These wire supports had a continuation of the groove as in the ring at *B* in Fig. 5 and were held in position by a headless shoulder screw that operated in a slot cut in the ring (these screws and slots are not shown) and allowed the proper travel to support the wire up high enough and in the proper position. Springs of sufficient stiffness were held in pockets in both the wire supports and die pot, as shown.

A more comprehensive view of the ring set in the die pot is shown in Fig. 7, also the wire supports extending beyond the face of the die, the diagonal lines showing the same amount of travel to the bottom when the wiring is complete. The pail body is placed inside the die, resting on its base and lightly along the sides. The wire is placed around the top resting in the grooves in the wire supports, putting the two loose ends between two of the supports. The punch descends and starts the metal around the wire, picks it up and incidentally forces the wire supports downward and along the taper of the pail body until they rest on the bottom, which finishes the curl. The action reverses and as the punch leaves the die, these wire supports then perform an additional function in releasing the pail body from the die for easy removal.

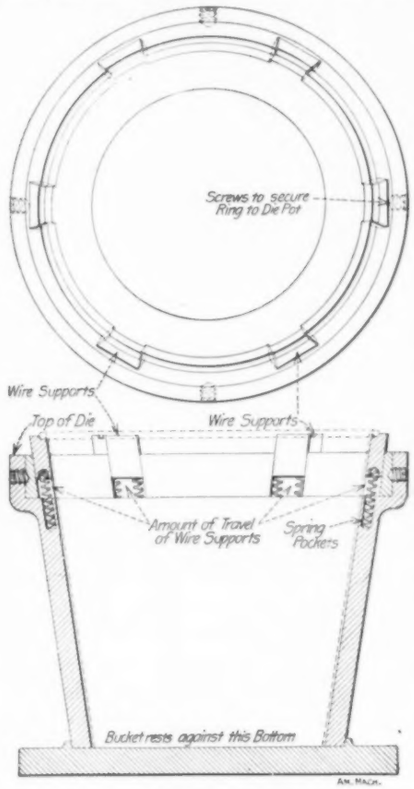


FIG. 7. ASSEMBLED DIE POT

The improvement, as before stated, is simple, overcomes the objection and defects of the original method, and rarely misses in operation. The punch is not shown as only a few minor changes were necessary. It was of the regulation type for this class of work.

A Miller for Cam Cutting

BY A. MILLER

As it may be of interest to some of your readers, I give below details of the temporary conversion of a miller for the purpose of cam cutting.

The machine was a No. 1 Milwaukee plain miller and the track had to be cut in the periphery of the cam. The lead screw was removed and in its place was substituted a bar of round, bright, mild steel of the same diameter as the lead screw at the bottom of the thread and slotted the greater part of its length like the lead screw. This bar was driven by the feed mechanism, in the same way as the screw, by means of a keyed adapting bushing, but having no threads did not engage the nut, thus allowing the table to travel irrespective of the revolution of the bar.

A gear wheel of another machine was then keyed on the end of the bar by a train of gears; this was connected to a headstock in the same way as for spiral gearing. A piece of 3x1-in. iron was forged in the shape of the letter L and another piece was riveted across the angle to stiffen it.

One arm was drilled to receive bolts which fastened it to the saddle of the machine, the other arm standing in a vertical position above the side of the table. The end of this arm was drilled for the riveting in of a pin on which was a hardened-steel roller. This roller followed the groove of the pattern cam which was used as a former and was fixed upon the same mandrel as the cam to be cut, the end of the mandrel being tapered to fit the headstock.

The cutter, an ordinary end mill of the right size, was fixed in the machine spindle in the usual way. All that was now required was to keep the former up to the pin as the cams revolved; this was accomplished by means of a bracket fixed to the saddle of the machine and projecting beyond the table at the end opposite the gears.

A pulley was fitted at the end of the bracket for a piece of two-inch belting to pass over, one end of which was fastened to the table, and on the other end was hung a weight.

The time spent in making the necessary fixtures amounted to 18 hours but now they are made the miller can be converted into a cam cutter in half an hour. It has not in any way affected its use an an ordinary miller, while as a cam cutter it gives satisfaction.

Coating for Iron and Steel

A new process of amalgamating a protective zinc alloy with iron and steel, under the name of "Lohmannizing," has recently made its appearance. Briefly, the process is as follows: The base metal is so treated as to accomplish a perfect fusion between the protective alloy and the base sheet, the alloy penetrating into the most minute pores and cavities of the sheet, becoming an actual part of it. Photo-micrographs of cross-sections of Lohmannized sheets show that there is a gradual shading off from the alloy to the base, indicating that a second alloy is formed between the original alloy and the protective metal. This thin exterior coating of alloy may crack, but because of the alloy formation with the sheet, this will have no effect upon the non-corrosive qualities of the Lohmann metal.

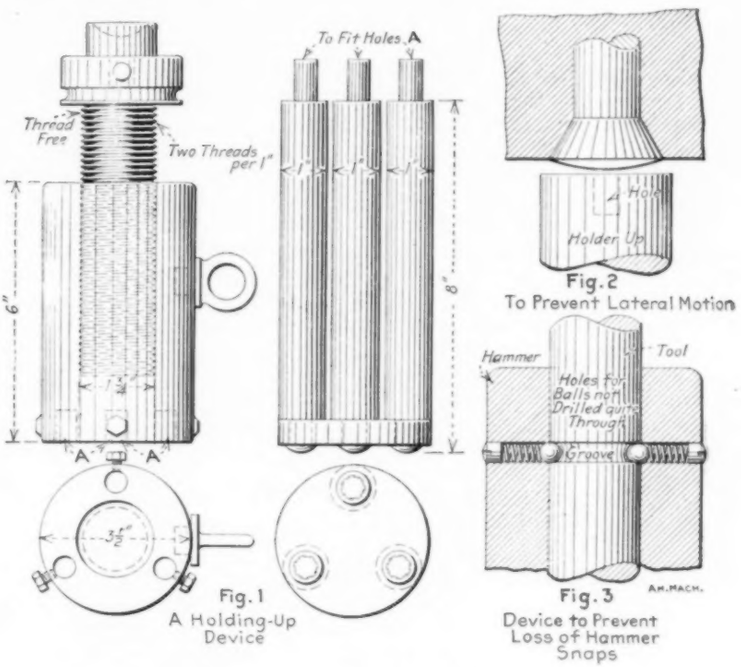
The Brier Hill Steel Co., Youngstown, Ohio., are licensees of the process.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Some Pneumatic Rivet Practice

The value of pneumatic tools is greatest on erecting and outdoor work, where the hydraulic plant and ordinary machine tools are not available. I do not think it can be seriously contended that, cost and workmanship considered, pneumatic can compare with hydraulic riveting.



SOME PNEUMATIC RIVET PRACTICE

A holding-up device successfully in use on a large and important job where space is limited, is shown in Fig. 1. The job in question is the renewal by new girders of the original members weakened by exposure and errosion. These girders have two spaces lengthwise, one 11 in. wide, the other 18 in. wide; the device shown is to hold up the rivets to be closed by pneumatic hammers inside these spaces. It is as much as a man can do to accommodate himself to the 11-in. section.

The holding-up jack is of solid construction, just a hole-tapping size of screw run right through a 3½-in. machine-steel bar. A snap fits into the screw end. For use in the 18-in. section, the legs shown are used as an attachment, the screw is free and the operator finds no difficulty in following up the rivet by keeping pressure on the bar. The weight of the jack is suspended by a ring and is not so clumsy in use as it looks. The men on the job prefer it to a regular pneumatic holder-up.

For countersunk rivets a roughened flat end is used, a holder-up of any description having a tendency to sideway movement. As an alternative believed to be better, Fig. 2 is submitted. A hole of moderate size is drilled from the end of the face, the edges of this, by giving a print on the face of the rivet head, should effectively prevent this side movement.

Riveting downward needs care to prevent the loss of the snap from the hammer when placing on the tail of the rivet to close, or when withdrawing it. The device shown in Fig. 3 efficiently guards against such losses sustained at a height or when working over a rivet; a whiff of air dislodging the base from the hammer when needed.

Hose connections are a frequent cause of annoyance, owing to breaks close behind the union. As usually made, the tail of the connection has a series of rings either rounded or buttress in form, turned in the gun metal forming tail. As an improvement, a thread of either shape, buttress or knuckle, would enable the man on the job to rejoint the connection with less trouble. A twisting action could be used to get the connection home. If the tail were slightly taper in addition it would help. It should prove possible also to use a slightly larger diameter tail. This would make a sounder job if the tail were taper.

Experience has proved canvas hose, several ply in thickness, the most satisfactory material for air hose. If reinforced it stands ill usage better than its modern substitute, flexible metallic tubing. The failure of canvas hose is invariably at the point where flexibility ceases, that is, where the tail of the connection makes the hose not flexible but rigid. The rational improvement to make is to render the tail of the connection flexible. The only material that suggests itself is flexible metallic tubing. Canvas hose can be securely fastened, owing to the steps of the metallic tubing, and it has the important advantage of being in the form of a helix.

Connections and unions suitably threaded for use with metallic tubing are to be obtained, and the tail of the connection can thus be flexible and 12 in. in length if desired.

I am afraid, however, that the makers of canvas air hose will not take kindly to the use of a rival material; this, however, should not prevent the makers of pneumatic tools from adopting a suggestion that will do away with one of the most exasperating and frequent causes of trouble.

London, England. A. L. HAAS.

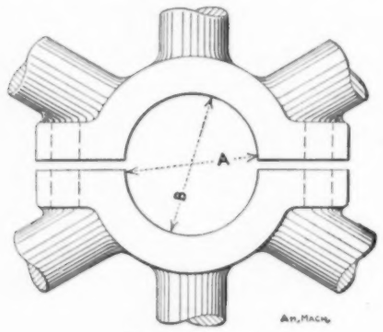
Trouble with Bores of Clamp Hub Pulleys

For years the complaint department of a large power transmission house had more or less trouble with the bores of clamp-hub pulleys and recently had complaints from one of its best customers. I visited the buyer's plant to smooth over the trouble and also to make a personal examination of the pulley.

Upon close inspection we found the bore to be out 0.028 at *A* and only 0.004 at *B*. Of course, the pulley was ordered back to the shop at once. The shop investigation brought out the fact that this error is nearly always present in clamp-hub pulleys and split pulleys, but as a rule is not more than 0.010 in. The wheel

in question was extra heavy, 20x16, 2 7/16 bore; the rim was about 5/16 in. thick at the center and 7/16 in. thick at the edges. The method of machining is as follows:

All pulleys are brought from the cleaning shed to the splitting department and the hubs fractured; then they are sent to the mills and bored, and then to the lathes for turning, by bolting onto a suitable mandrel, and finished. When the mandrels are withdrawn, after loosening the bolts, we find that the bores open



THE PULLEY

and in this case 0.028 was caused evidently by the removal of scale, and the peening effect of the cutting tool on the rim.

To overcome this trouble we have made a fixture for the boring-mill platen on which the pulleys are fastened by the arms and the rim finished first, but finishing the whole wheel before removing. By this method we get a much more satisfactory job and at a cost that is increased only about 4 per cent. The tool rate on the mill is greater than the lathe but this is offset by the fact that bolting on the mandrel and one handling are saved.

Some time ago we had a clamp-hub pulley to make, with a rim 1¼ in. thick and 14 in. wide, about 48 in. in diameter, 6 5/16-in. bore, with a ring cast on the arms for a Hill clutch 36 in. in diameter. When the hub was fractured it was found that the tendency of the break was to close after the wedges were withdrawn. It was necessary to slot out the proper clearance before boring and as near as we could tell the hub closed about 1/32 in.

After boring, clamping on the mandrel and turning, it was found to open about 0.018 in. in the bore, due evidently to the relieving of stresses set up in cooling. Have any of the readers of the AMERICAN MACHINIST experienced such trouble?

GEO. H. MASON.

Philadelphia, Penn.

For Turning Hollow Columns

I was on the point of writing to the AMERICAN MACHINIST in reference to this subject, when, glancing through the pages thereof, a column of this type caught my attention. This column has a bar cast across the end for the purpose of centering it in the lathe, and, perhaps, grinder.

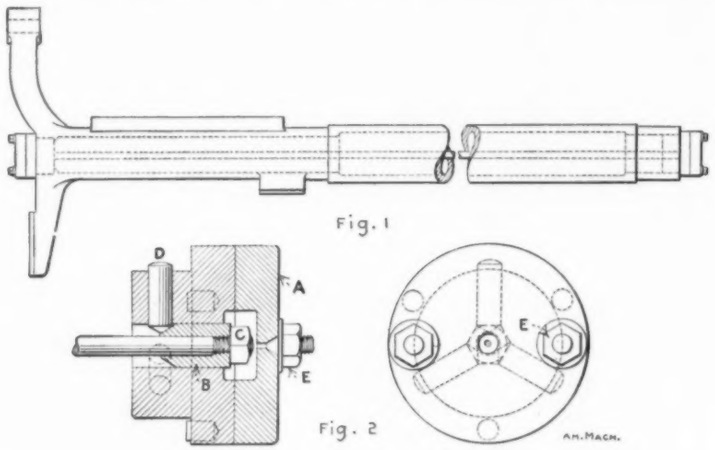
This is very interesting to me as superintendent of a works producing sensitive drills having a column of this type. I must confess that I have never seen a column cast with a bar in the ends, as shown. The practice in this country is to make the cores for this class of casting, on lengths of gas or steam tube drilled all over for the escape of gases, and wound with hay band, finished off with a coating of loam.

This method of core making makes it ractically impossible to cast bars in the ends, and it was this condition that led to the design and use of the center blocks, which I will describe:

The column, with blocks in position, is represented in Figs. 1 and 2, the same showing detail. The holes in the column are 2 5/8 in. and 1 7/8 in. The blocks are made from machine steel, case-hardened. The piece *A*, containing the center hole, is adjustable about 1/8 in. from the center in any direction. The cone *B* is screwed on tight at one end of the long bolt, and at the other end is a sliding fit. In use, the block with the fast cone is left on the bolt, which is passed through the column and the other block is pushed onto it.

Previously, of course, the piece *A* is taken off; the nut *C* is then tightened, thus pressing the two cones on the pieces *D* and gripping the column firmly at each end. The piece *A* is replaced and nuts *E* tightened. The column is now placed between the lathe centers, where it is set true by slackening nut *E* slightly and knocking in the required direction.

When all is satisfactory, the nuts are screwed up and the job is ready for machining. A column may be centered in a few minutes by this rig and is perfectly secure. I forgot to mention that we only turn, file and polish these columns. If it were necessary to grind them, the cast-bar method would, perhaps, be better.

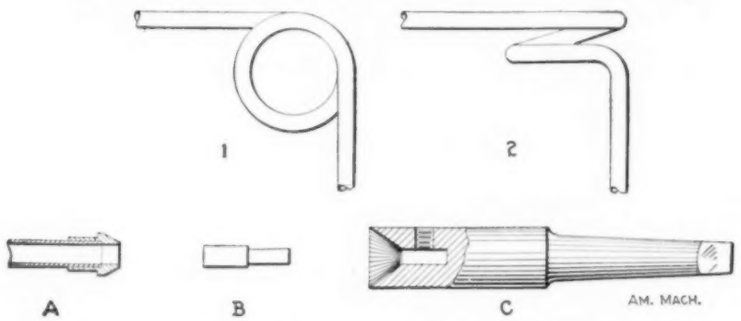


FOR TURNING HOLLOW COLUMNS

Derbyshire, England. J. J. SHAW.

Tool for Reseating Nipples After Damage to Seating

In the automobile industry many pipes have to be fitted with nipples, which are usually brazed on. In this operation the seating is frequently damaged, and owing to the peculiar shape assumed by some pipes they are subject to damage in storing. The result of this is delay and annoyance.



TOOL FOR RESEATING NIPPLES AFTER DAMAGE TO SEATING

The rough and ready way of filing up and grinding-in is expensive and unreliable. I have designed a tool that restores the seating to its original degree of accuracy. In large productions an old and disused driving head can be fixed up

to do the work, but should this be out of the question a driller will serve the purpose, when the shank should be made to fit the spindle as shown.

The seating tool *C* is bored taper to suit the nipple standard seating. It is also bored to fit the steady-pin *B*. The use of the tool is very simple. When revolving the brazed pipe and nipple, *A* is simply pressed over the steady-pin *B*, against the cutting edges on *C*. If care has been taken to make these the right cutting angle a clean facing results in less time than it takes to describe the operation.

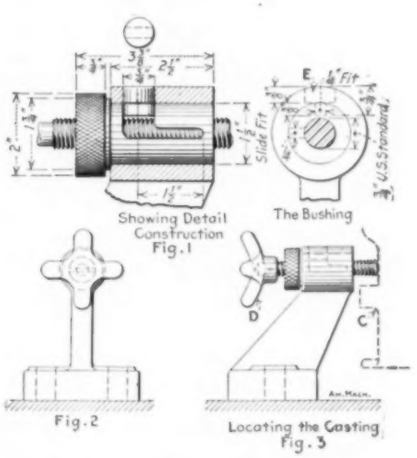
These tools can be made for standard sizes, but in jobbing work the cutter *C* can be made to suit several sizes, in which case only standard steady-pins for each size need be made. When such a course is adopted they should be secured by a screw to keep them from turning. It is also advisable to make up reamers slightly above the size of the hole. These should be fitted with lever pins to save time obtaining wrenches. This makes a better bearing surface and also cleans out any brazing metal that may have run through.

The teeth on *C* were cut in the following manner: A dividing head from the miller was placed on the slotter and set over to a suitable angle, and a few trial cuts taken to get the cutting edge to a perfect line, as it can be seen that these teeth are cut on a cone. Owing to the success of these, a set was made to fit the hand brace for repair work.

Bristol, England. J. C. H.

A Quick Releasing Fixture

A problem which often presents itself in jig and fixture design is to have one with a quick release. This is desirable as it enables the removal of the piece after machining and also helps to locate it before machining. It is also a time saver.



QUICK-RELEASING FIXTURE

A problem of this kind requiring such a fixture recently presented itself. The cut shows how the difficulty was surmounted in an inexpensive and satisfactory way.

The fixture assembled is shown in Figs. 2 and 3. The boss shown at *C*, Fig. 3, makes it necessary to draw the screw to permit placing the casting on the miller, on a number of location dowels. This, of course, is also necessary when removing the casting after machining. The detail construction of the fixture is shown in Fig. 1.

The bushing is made of machine steel, a good sliding fit in the casting, and hardened. The notch is cut in the bushing as shown at *E*, and the head is knurled. The pin is made a tight fit in the casting and fits in the slot in the bushing.

To operate the attachment remove the piece after it has been machined. Taking hold of the knurl on the bushing, give it a quarter turn; this brings the slot in line with the pin and makes it possible to draw out the bushing and the screw which is carried in the bushing, thus leaving the casting clear to be removed.

After putting in the new casting to be machined, by reversing the operations described, adjust the screw to hold the casting as desired and give a turn on the knob, Fig. 3; any desired resistance is thus presented to the cutting pressure of the tool. ROBERT MAWSON.

Providence, R. I.

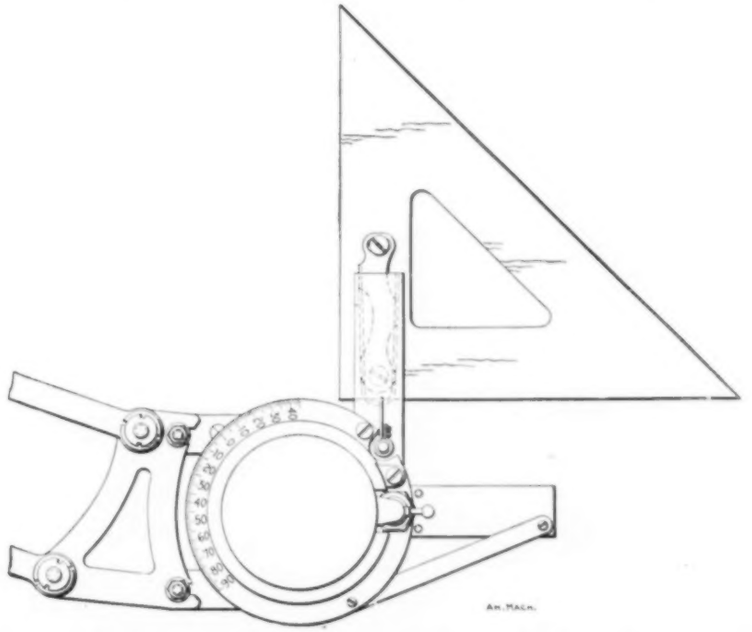
A Triangle for the Universal Drafting Machine

Some time ago I fixed a 45-degree triangle for use with the universal drafting machine for inking short lines or small drawings by taking one of the taper pieces off a scale and attaching it to a regular 45-degree triangle. The difference in thickness between the triangle and the scale had to be made up with a thin piece of wood which was cut the same shape as the taper piece.

The taper piece, of course, fitted firmly in the socket of the machine. I found the edges of the triangle much easier to ink by than the regular straight-edge which comes with the machine and a variety of angles can be inked without much change in the swiveling head.

A. J. DEXTER.

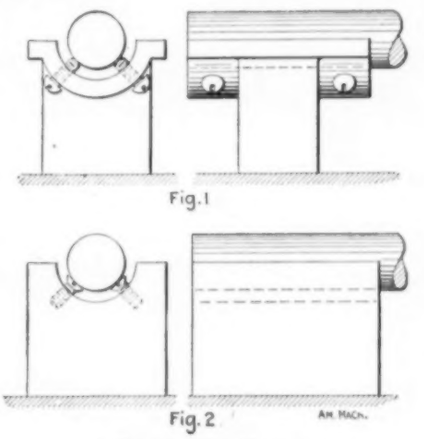
Indiana Orchard, Mass.



A TRIANGLE FOR THE UNIVERSAL DRAFTING MACHINE

A Babbitting Method

When doing a babbitting job where it is necessary to line and level the shaft, the following method will be found very useful:



A BABBITTING METHOD

Drill and tap into the casting and insert two flat-head machine screws at each end of the shaft or at the outer end of each bearing. By adjusting these screws the

shaft is very easily located. In the case of a very light shaft it will be necessary to clamp it lightly to prevent its raising off the screws where the babbitt is poured.

Where the casting is constructed as in Fig. 1, the holes may be drilled clear through and the screws inserted head down, which will make the adjustment more convenient. But with the construction shown in Fig. 2, it will be necessary to insert the screws head up. After pouring the metal, the screws may be removed and the holes filled up.

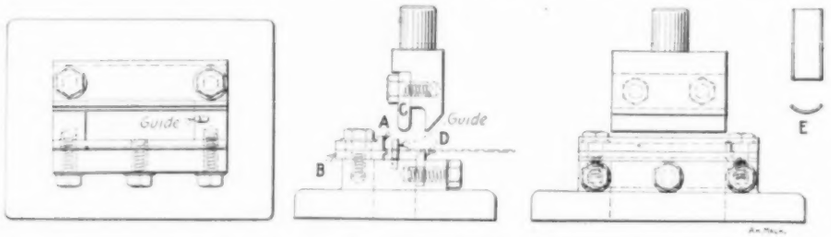
To prevent the metal from running out at the ends of the box, cardboard is often used and the holes for the shaft cut with a knife. A very neat way which leaves a round, smooth hole is as follows: Take as many pieces of the cardboard as will be needed and clamp them between two boards; then drill a hole the size of the shaft. A coat of lampblack, mixed with oil, on the cardboard will improve the appearance of the finished job.

Cleveland, Ohio. ALLAN R. COE.

A Cutting and Bending Die

The diagram is of a press tool for cutting and bending at one stroke of the press, the piece shown at *E*.

These pieces, when made, are used to thicken up the D-shaped tubes of a bicycle frame, at the places where the bolts and spindles go through. The parts marked *A* and *B* are two separate pieces with slots in them for regulating the width and amount of bending. The part marked *c* on the punch is purposely made



A CUTTING AND BENDING DIE

separate to enable packing to be placed between it and the body of the punch to get it about central between the guide or stop marked *A* and the cutting edge *D*.

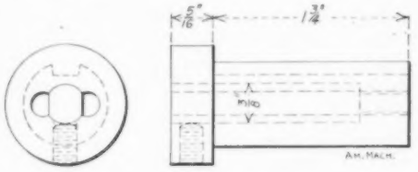
This tool is a great improvement on the old ones, with which we cut off and bent, in two separate operations.

Birmingham, Eng. JAMES STONE.

A Socket to Overcome Driving Trouble

I have a considerable amount of tapping in steel to do, and have been caused much trouble by a machine tap-driving, parallel socket, where the tap was held by a setscrew pasing through the collar into an indentation in the tap shank. This hold was found to be inadequate to resist the torsional strain from the tap in action.

The diagram shows the improvement I made in the socket, which overcame the driving trouble. A piece of ⅜-in. drill



AN IMPROVED SOCKET TO OVERCOME DRIVING TROUBLE

rod was inserted into the tap socket; then two $\frac{3}{16}$-in. holes were bored 1½ in. deep, opposite each other, down the sides, to receive the drivers; the protruding sections of these were made flat, to contact corresponding flats on the tap shank. A piece of rod flattened the necessary amount was inserted into the socket to prevent the drivers from deviating from their course when being driven into position.

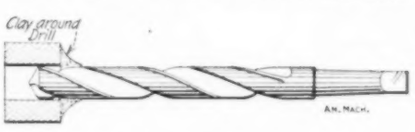
It is best to retain the service of the original setscrew, as it serves to facilitate the extraction of the tap from the tapped hole. ANDREW WEBSTER.

Glasgow, Scotland.

False Center for Grinding Drill Bodies

We had occasion to use a bastard size drill and as it was a high-speed drill that was required I took one from stock and ground it down to the required size. This drill had only one centered end and had to be centered on the cutting end in order to have two centers for grinding. It was centered in the following way:

I first made a mold of cold-rolled stock



FALSE CENTER FOR GRINDING DRILL BODIES

as shown in the diagram, then held the drill in the vise and poured in babbitt metal, making a false end on the drill. The mold should be made deep enough to allow the babbitt to run down the flutes of the drill about a half inch or so and just far enough above the end to allow for a center. After the end is cast on it can easily be forced out of the mold and centered in a true chuck, after which it is ready for grinding to the required size.

I had no more trouble in grinding than if it had been solid. Babbitt does not stick to the wheel; the end holds very firm and can be broken off by tapping on the vise, or rather must be broken off.

JOHN T. LLOYD.

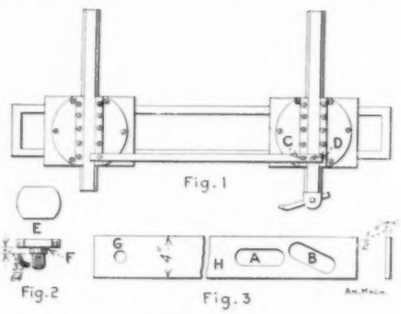
W. Philadelphia, Penn.

Borer Rig for Sheave Wheels

The accompanying diagram shows a rig which I used successfully on a 10-ft. borer for machining large sheave wheels.

In Fig. 3 is shown a steel bar *H*, ½x4 in. and of suitable length with the slot *A* parallel with the center line and the slot *B* of the same angle as that to be machined.

A small steel bushing (not shown) to fit bolt *C*, Fig. 1, is made $\frac{1}{64}$ in. longer than the thickness of the bar *H* to allow



RIG USED ON BORER FOR MACHINING LARGE SHEAVE WHEELS

free motion, the outside diameter of which is a running fit in slot *B*. A hole is then drilled and tapped in the ram at *D* for the stud *E*, Fig. 2, which is not shown in place in Fig. 1. The diameter *F* of the stud *E* is made a running fit in the slot *B*. A hole *G* is drilled in the bar *H* by which it is firmly bolted to the left head of the mill.

In Fig. 1 the bar *H* is shown in position. The left head is locked in position, a suitable washer and nut are furnished for the bolt *C*, and the stud *E* is put in position at *D*. The tool is then set somewhere near the beginning of the first cut by lowering the rail, when it can be adjusted by knocking up or down with the hammer.

The friction clutch on the right head is loosened and the crossfeed put in. As the head feeds over it will push the ram down on the bevel of the slot *B* and, of course, cut the desired bevel in the sheave. To cut the bottom bevel it is only necessary to turn the bar *H*.

LAWRENCE HULME.

New Castle, Penn.

Discussion of Previous Question

Referring to letters and articles previously published

Grinding Chilled Cast Iron Rolls

There is one particular phase of grinding on which a wide difference of opinion seems to exist, i.e., how to secure maximum reduction of the work. This was again brought to mind by the article by J. H. Hollinger, in Vol. 35, page 799, on the subject of grinding rolls.

Some five years back I carried out experiments with a view to arriving at a solution as to the best method of securing maximum reduction, and the conclusions formed then, and strengthened since by subsequent experiments and a long series of observations, were: That for any given work-speed maximum reduction is obtained by using a wide traverse and a shallow feed.

Generally speaking the conclusions were that the reduction in diameter of the work should not be more than 0.002 in. per pass, while the traverse should be slightly less than the width of the wheel.

It follows from the above, that when I saw that Mr. Hollinger had used a feed of 0.006 in. per pass to rough out his roll —well! I sat up.

Now I am unfortunate enough to possess an analytical turn of mind and a slide rule, so I endeavored to analyze Mr. Hollinger's results and compare them with my own conclusions on the subject of shallow feed.

In roughing his roll Mr. Hollinger used a work-speed of 52½ ft. per minute; traverse per revolution of work ⅞ in.; depth of cut 0.003 in. (equal to a reduction of 0.006 in diameter), and consequently the material removed per minute —ignoring for the moment the wear of the wheel—was

$52\frac{1}{2} \times 12 \times \frac{7}{8} \times 0.003 = 1.65$ *cu.in.*

approximately.

Total amount of material removed from roll equalled 221 cu.in.; therefore, the total time of reduction—still ignoring the wear of the wheel—would be

$$\frac{221}{1.65} = 2 \textit{ hr. } 14 \textit{ min.}$$

But Mr. Hollinger tells us that the wheel was reduced $\frac{18}{32}$ in. in diameter during this job, and allowing $\frac{3}{32}$ in. of this for truing the wheel, once during roughing and two or three times during the finish, we find that the wheel wore $\frac{16}{32} = \frac{1}{2}$ in. while the work was reduced ¼ in., or, the wheel waste was twice as much as the work reduction.

From this we find that the actual reduction per pass would pan out about 0.002 in., and the time to reduce the roll would be 6 hours 42 minutes and this is not in agreement with the time given.

The wear of the wheel given is abnormal and is proof positive that too much cut was put on and that the wheel was *wasting* instead of wearing. The wheel cost should only be studied in terms of cubic inches *removed per minute* and that when a wheel is wasting it is not doing work.

Let us follow up the theory of light cuts and broad traverses. As the wheel used by Mr. Hollinger was 2 in. wide,

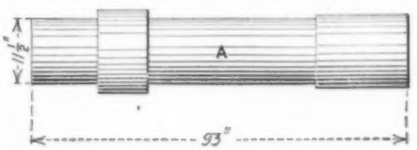


FIG. 1. GRINDING CAST-IRON GAGE

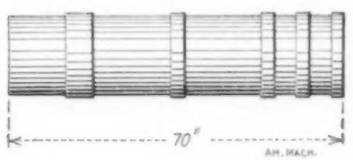


FIG. 2. TROUBLESOME STEEL CYLINDER

and all well designed grinders should give a traverse the width of the wheel, let us assume 1¾ in. traverse, and a reduction per pass of 0.002 in. The material removed per minute under these conditions—work-speed as before—would be:

$52\frac{1}{2} \times 12 \times 1\frac{3}{4} \times 0.001 = 1.1$ *cu.in.*

and the time taken to remove 221 cu.in., would be:

$$\frac{221}{1.1} = 3 \textit{ hr. } 21 \textit{ min.}$$

Under conditions similar to the above I have found the wheel wear to be about 10 per cent. of the work reduction (diameter) on a two-foot length; therefore assuming wheel wear as 20 per cent. in this case, we get as the total time under these conditions approximately four hours and this agrees with practice.

With a wheel 3 in. wide, using a traverse of 2½ in. per revolution and the same work-speed and cut as before, this job could be roughed out in 2 hours 40 minutes.

In the above analysis I have followed Mr. Hollinger's lead so far as the work-speed is concerned, but if I had similar rolls to do I should run them about twice as fast, say 20 revolutions per minute while roughing out, and cut the times quoted in half—that is if the belts would pull it.

Removing material from rolls or other solid pieces of large diameter is the simplest of all jobs on the grinder, but for pure unadulterated cussedness there is nothing like a tube whether it be large or small.

Small tubes can be controlled somewhat with the stays, but tubes of large diameter, where stays cannot be used, invariably upset conclusions that are based on solid jobs.

Take for instance the large hollow cast-iron gage shown in Fig. 1. This had a 9-in. hole through it and the largest diameter was about 14 in.

It was ground on a 18x168-in. Norton plain grinder, using a 24 combination *K* alundum wheel running at about 5000 ft. In grinding the middle part *A*, the wall of which was only 1⅛ in. thick, it was noticed that the work was constantly going out of true—first to one side, and then to the other—and this was undoubtedly due to heating effect. The work-speed was about 36 ft. and the traverse 1¾ in. per revolution.

By doubling the work-speed, and thus halving the traverse per revolution, the work remained true and the wheel cut fine until the speed was dropped to 36 ft., when the work again began to run out of true. This was repeated several times—always with the same result. Undoubtedly the heat generated by the wheel could not be dissipated by the material when running slow and consequently this caused an expansion along the side being ground. When the work was revolving faster the heat was spread over more of the circumference and the piece expanded more regularly instead of bowing.

Another piece that caused considerable trouble is shown in Fig. 2. These large hollow cylinders were of good quality mild steel, the largest diameter being about 16 in., and the bore varied from 11 to 14 in.

In this case peculiar heating effects were noticed which were, no doubt, due to the irregular thickness of the material at different places along the piece. The wheel used was a Norton 24 combination *K* running, about 5600 ft., and the best results were obtained when using high work-speed—about 100 ft. per min-

ute—with a traverse of about ¾ in. per revolution; the feed per pass for roughing was 0.002 in.

The time taken to do these pieces varied between 7 hours and 3½ hours, which shows the uncertainties of tube grinding.

As mentioned before, it is these tubular jobs that seem to upset all our theories founded on solid work. It would be interesting if Mr. Hollinger and some of the other contributors would give us the benefit of their experiences on hollow work.

WALTER G. GROOCOCK.

Woolwich, Eng.

A Gearless Relieving Attachment

I read some time ago of a simple relieving attachment. Below is the description of another.

This form of relieving attachment is simple and does not necessitate the use of gears. It consists of an arbor *A*, Fig. 1, a cam or ratchet wheel *B* the teeth of which correspond in number to those cut on the blank, a cam follower *C*, a small

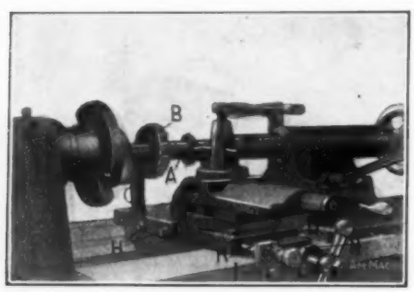


FIG. 1. SIMPLE FORM OF RELIEVING ATTACHMENT

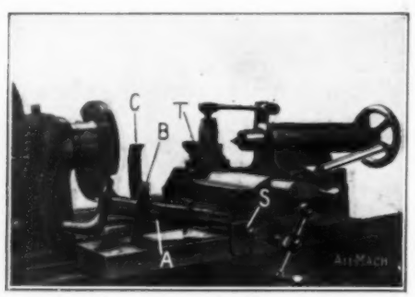


FIG. 2. GEAR-TOOTH CUTTER BEING RELIEVED

flat iron bar *D*, a spring *S* and a thumb-nut *N*.

To operate, first cut the teeth in the blank, then place the ratchet cam, washers and blank on the arbor as shown in Figs. 1 and 2. Loosen the gib screws, also the nut on the end of the cross-feed screw, so, as to permit the cross-slide to move freely at least ¼ inch. Fasten by two screws *H* the cam follower *C* on the cross-slide, as shown in Fig. 1. Fasten a small rod *R* about ½ in. in diameter on the end of the cross-slide. Bolt *D* to the apron by the screw *I*. Place the spring and the thumb-nut as shown and tighten the spring enough to bring the carriage forward or toward the front of the lathe. Finally adjust the cam and the blank so that the tool *T* will move in when the cam *B* pushes the follower *C* back.

When the follower *C* drops into a step on *B*, the cross-slide is drawn forward by the spring *S*, thus bringing the tool *T* into position to begin the next tooth on the blank. When this adjustment has been made, tighten nut on the arbor sufficiently to prevent slipping.

The views show a gear-tooth cutter being relieved by a formed tool, but any cutter, such as a double-angle cutter can be relieved as easily by using the compound rest for angular cutters.

Ames, Iowa. J. HUG.

Efficiency in the Drafting Room

I was recently greatly interested in "Entropy's" article on "Drafting Room Efficiency," in Vol. 36, page 199. I believe that scientific management can be applied in the drafting room as well as in the shop, although probably not to as great an extent. The study of efficiency is essentially a study of speed, and I realize that any attempt at speeding up the draftsman must be made in a manner that will in no sense tend to impair the accuracy of the drawing.

Certainly the high-priced man, the machine designer and those who check drawings and figures cannot be rushed. Such men must, of course, be accurate and the speed at which they work is, to say the least, of secondary importance. But consider the vast army of detailers, tracers, blueprinters, etc. Upon them falls the actual physical work involved in getting out a set of drawings. Can we pass them over lightly without studying them, as we are beginning to study the machinist?

I agree with "Entropy" that good air and good light are the best aids to efficiency in the drafting room. But this fact is already practically universally recognized, and a drafting room is invariably given the best that the building affords. Add courteous treatment by executives and a general hum of industry, as "Entropy" suggests, and you have undoubtedly relieved the draftsman of much that might retard his work.

But shall we provide these principal aids to efficiency and refuse to investigate further? How about the multitude of little things—for efficiency is but a study of little things—in totals. Let us take a shop employing ten draftsmen or more. How many minutes a week are wasted in walking after tracing cloth and drawing paper; and possibly in cutting it off? Could not a four-dollar-a-week boy see that each draftsman was constantly supplied with a few sheets of each size used? Could not a neat boy, fresh from school, put in all border lines and titles, thus leaving the higher-priced tracer free to do a higher class of tracing constantly?

How many draftsmen do both detailing and tracing? Why use a man in tracing when he is competent to detail from an assembled drawing? Of course, this is necessary in the small shop, but could not the work be more efficiently assigned in the large shop? In most drafting rooms the junior draftsmen are under the direct supervision of the designers. It frequently happens the designer is too busy to give them attention at the exact time that they require it, and considerable time is thereby lost. And when the designer has no further work for the junior, there is usually time lost before the junior is assigned to assist some other designer. Could not the work of these juniors be planned in advance far more systematically than at present?

Drawings are so stored in modern drafting rooms that they may easily be found. But is not there room for a little improvement in many shops? And do not many high-priced men spend too much time in either looking for drawings or in waiting to have them brought to them? Is there any necessity for even a fifteen-dollar-a-week man spending one minute in hunting for a drawing? Could not things be arranged so that he could spend all his time in doing the best work that he is capable of?

Fully 50 per cent. of the tracers do not possess every possible time-saving tool, such as section-liners, Payzant pens for heavy lettering, pencil sharpeners, etc. Would it not prove profitable to have such tools in the drafting room, to be loaned in the same manner that tools are loaned to the machinist?

In the columns of the AMERICAN MACHINIST appear constantly accounts of time- and labor-saving devices for draftsmen. Many of them are excellent; many could be used to advantage everywhere; others on only a certain class of work. Doubtless many draftsmen are adopting these suggestions. There are many who never hear of them, and there are probably many who read them, approve of them—and then forget them. Would it not be well to have each one studied and tried out, and if found by actual experiment to be an improvement on present methods, to insist on its being used by every draftsman in the department?

Now I do not claim that the adoption of these suggestions will necessarily improve the efficiency of a drafting room. Possibly all of them would prove practical; possibly none of them. I ut I do claim that if we are going to study efficiency, there are many things in the drafting room which should be discussed and experimented with before we can place the seal of approval upon the efficiency of the present-day drafting department.

P. N. GREEN.

West Somerville, Mass.

The Construction of Cam Diagrams

By Ernest Mounsey

When designing a machine in which a number of motions are performed by the use of cams, it is necessary in the first stages of the work to plot a diagram showing the cycle of operations and the relative position of the parts. The methods for marking out cams have been treated fully by previous writers, consequently no attempt to cover that ground will be made. There are, however, one or two points interesting to readers as time and labor savers in the preliminary work of diagram construction.

A good fundamental rule is never to plot the various motions required on one base line, as the diagram gets too confusing to read; instead always set out each motion independently, one above the other, as shown in Fig. 1. The position of most of the critical points is estimated as a percentage of a cycle, but as these are sometimes required in degrees, for instance, when marking out the templates for face cams, a scale of degrees, as shown at the top of the chart, so that one kind of reading may be readily converted to the other will be found useful. The blank diagram was drawn and inked in on tracing linen, omitting the horizontal base lines.

The diagram plotted in Fig. 1 is intended to be only diagrammatic, as it is unnecessary to show the exact shape of the cam development. Thus the critical points are shown connected by straight lines; to be correct they should be curves; see Fig. 2 for a comparison of such curved and straight lines.

Finding the Slope

Many persons limit the slope of the cam to 30 deg., while others go up to 40 or 45 deg. The allowable limit depends on circumstances, and should be governed by the designer's judgment. In order to avoid exceeding a predetermined angle, set out the height of the diagrams in correct proportion to its length; a glance will then disclose if too great a slope is being used. The true development of a portion of the curve is shown in Fig. 2. The limiting angle BAC is a tangent to the curve at G, and the corresponding angle obtained by drawing a straight line connecting the ends of the curve will be EDF.

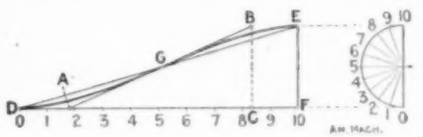


Fig. 2. Angles of the Cam Curves

Slopes are drawn on the chart for angles of 30, 40 and 45 deg. for ready reference. To make the height and length of the diagram in correct proportion for any diameter of cam, proceed as follows: Set up HI, Fig. 1, equal to one-tenth of the length of the chart. The diameters of the cams are determined by the general design of the machine. Along a sloping line mark HK, equal to one-tenth of the circumference of the cam under consideration, join JK. When LK is greater than HJ, it is most convenient to make the slope HK so that HJ is horizontal.

Mark off, full size, HL and LM, the movements required by the cam roll, and project on to HJ, with lines parallel to JK. Then KN and NO represent the heights of the cam diagram to the same scale as its length and the slopes of the lines in the diagram will be the same as on the actual cam. Such a chart as this shows at a glance the operations to be performed at any portion of a revolution of the machine and prevents any possibility of one motion fouling another.

The next stage—laying out the templates for the manufacture of the cams—requires no detailed consideration, as it is a simple matter to draw the curves connecting the critical points. Care should be taken that the movement obtained is forward and not backward. The chart reads from left to right, but the templates may read either way, according to the direction of rotation.

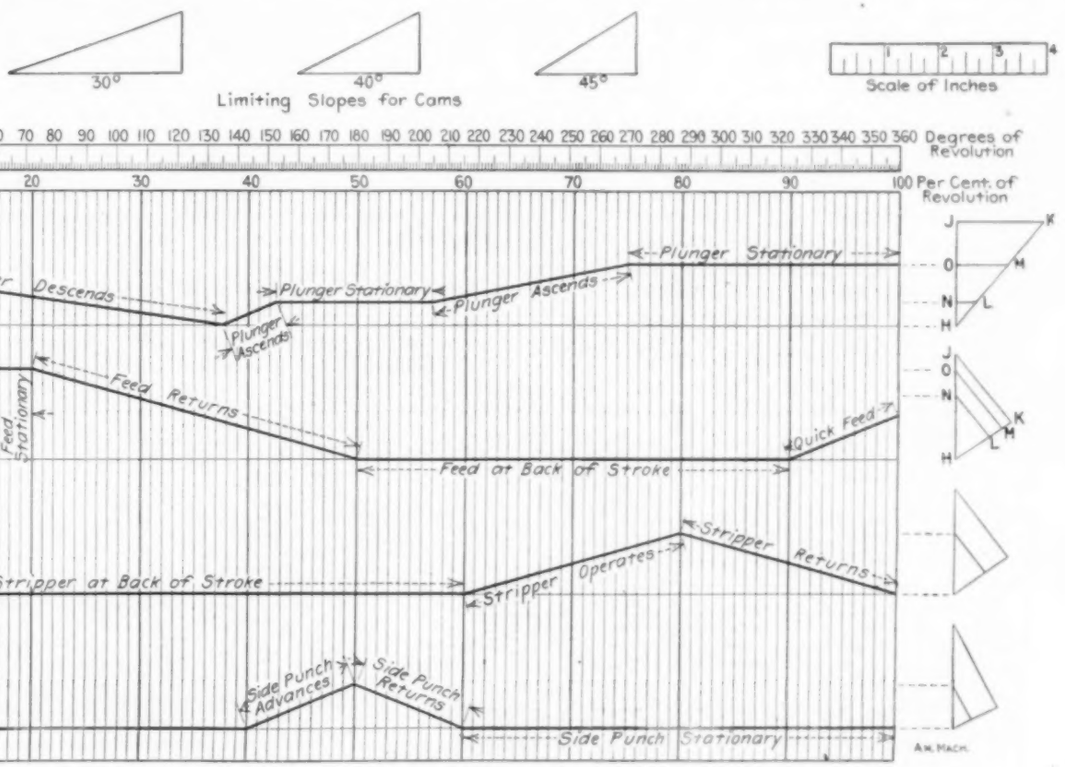


Fig. 1. Diagram for Typical Cams

Rolling mills which manufacture nickel alloys, have found manganese of great assistance in obtaining malleable metal. It is now extensively used in producing sound nickel alloy castings, and has made it possible to roll nickel alloys previously considered exceptionally refractory. It is the natural deoxidizer for nickel and its alloys.

Standard T-Slots

By Carl G. Barth*

In his address before the National Machine Tool Builders' Association last fall, on standardization of machine tools, L. P. Alford pointed out the desirability of standardizing T-slots. To this proposal I can give my most hearty approval, as in the shops that I have systematized it has unfortunately been found necessary to spend a great deal of money in bringing about uniformity in this detail of construction. All of these sums might have been saved if the manufacturers had originally furnished their machines with T-slots conforming to some accepted standard.

The illustrations presented herewith are reproductions of the actual working drawings used at the Watertown Arsenal in remachining the slots in machine tools to take standard T-bolts. The proportions of the bolts and their respective normal T-slots are shown in Fig. 1. Seven drawings, which are reproduced in Figs. 2 to 8, inclusive, were required to show the various slots as they were found and the needed changes. These original slots are indicated by the broken lines, and the dimensions to which they were machined by the full lines. Here the machine to which a slot belongs is indicated both by its new working symbol and by its old shop number, the latter appearing in parentheses.

*Consulting engineer, Philadelphia, Penn.

All of the drawings are presented in great detail, with the hope that they may act as a powerful, though silent, admonition to machine-tool builders to adopt some standard T-slots and bring them into general use. In this connection it might be well to give due weight to the standard adopted by William Sellers & Co. over a quarter of a century ago.

In Figs. 2 to 8, 140 machine tools are listed. Of these, 119, or 85 per cent., required some changes. A study of Fig. 1 will show that the standard T-slot dimensions are not unreasonable, but on the contrary, represent consistent design.

Organization of Efficiency Society

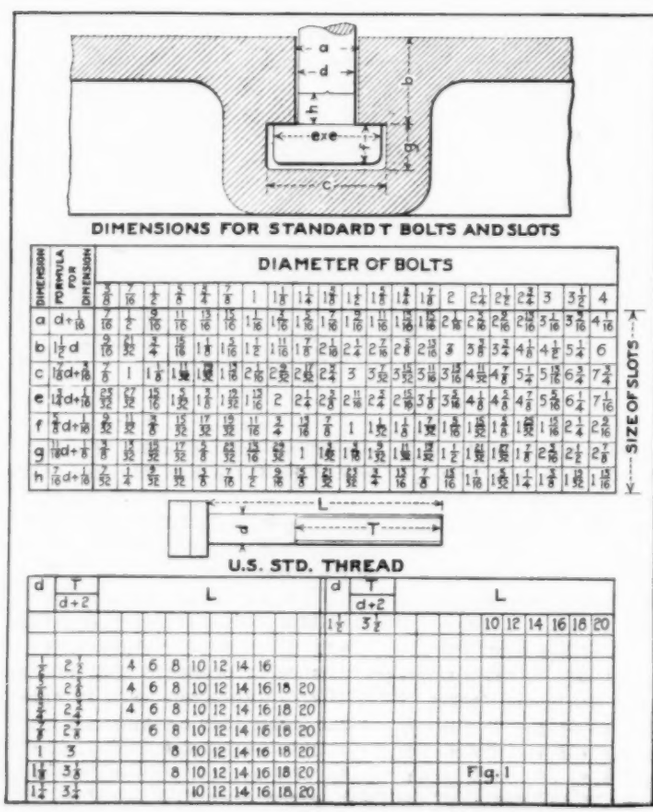
On March 18 and 19, in the Engineering Societies' Building in New York, was held the meeting for organization and the first annual convention of the "Efficiency Society." The sessions of Monday included the report of the organizing committee, the discussion of the constitution and by-laws, the presentation and discussion of a number of professional papers, and a banquet in the evening. Both sessions of Tuesday were devoted to the reading and discussion of professional papers.

The two most noticeable features were the enthusiasm of the organizers and members—some 700 men have signified their intention to join—and the extent of the field covered by the speakers. One section of the constitution as originally drafted reads: "Its object [the object of the Society] is to bring about increased efficiency in every activity of man and in everything that he employs."

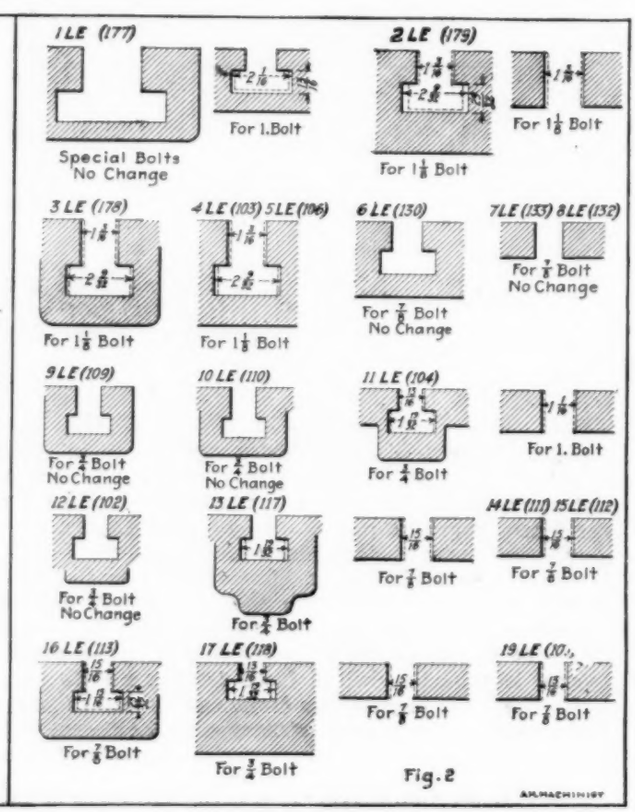
The speakers lived up to this statement, and the addresses ranged from advertising to the reorganization of the navy, and from scientific management in a machine shop to efficient methods in legal procedure and practice. This is spreading out very thin, yet every marathon champion was once a sprawling youngster.

The organization adopted is more like that of a business corporation than a membership corporation, for all of the officers are to be elected by a Board of Directors, and this board is supreme in the affairs of the society. In fact, there seems nothing for the ordinary member to do, except to cast his ballot for directors at the annual meeting. The officers have not been elected with the exception of the president, who is James G. Cannon, chairman of the organizing committee.

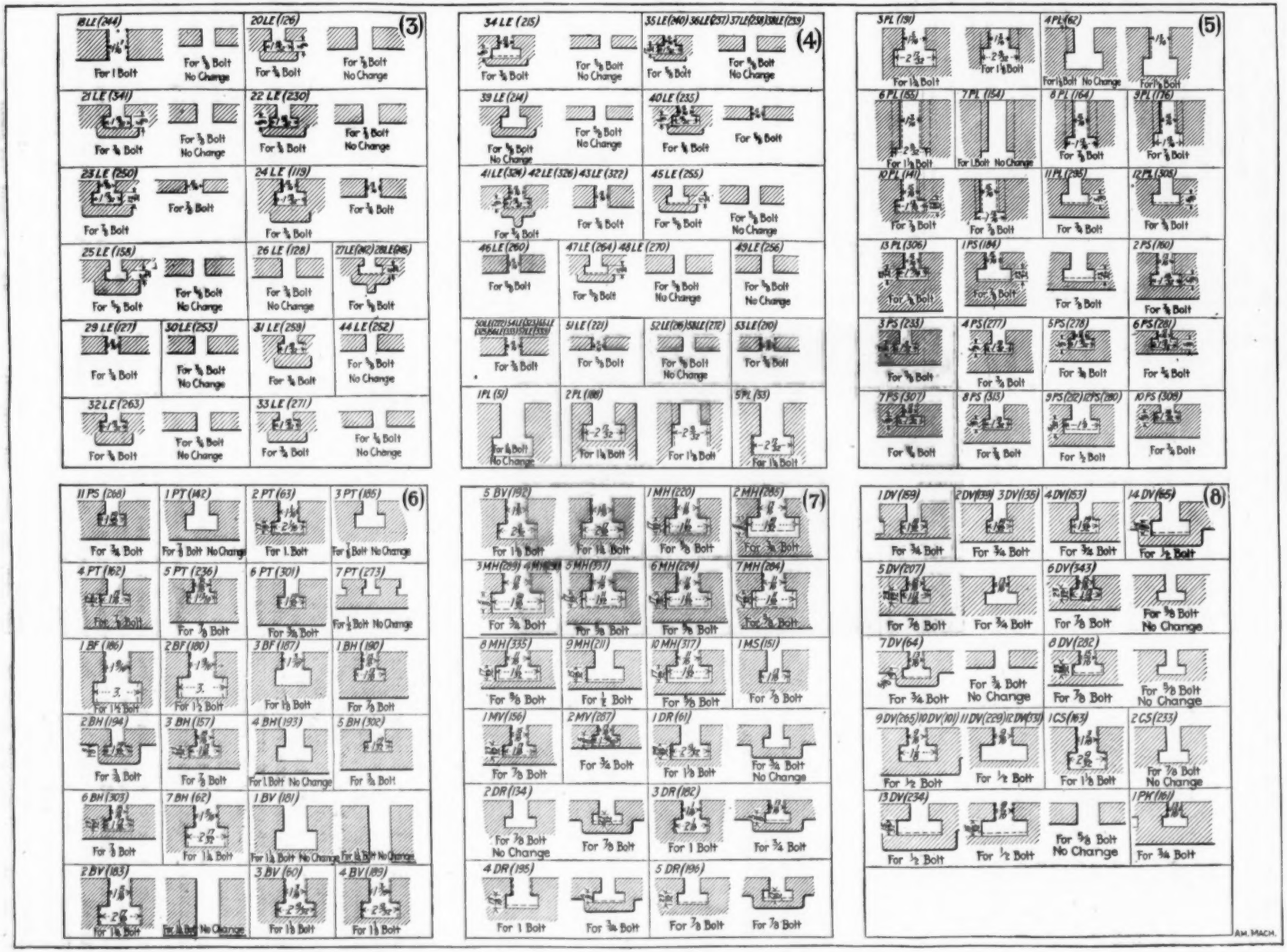
The organizers apparently believe that there is a wide field for the activities of the society and that in time it may become one of the most important, if not the most important, scientific body in the country. To measure up to this vision is a big undertaking. The need exists and it is sincerely to be hoped that the society will be well directed in all of its work.



PROPORTIONS OF BOLTS AND RESPECTIVE NORMAL T-SLOTS



SLOTS REQUIRING CHANGES



A Large Variety of T-slots Found in Use Requiring Changes

Rear Admiral Melville

Rear Admiral George Wallace Melville, U. S. N., retired, noted as an engineer and explorer, died at his home in Philadelphia on Mar. 17 from paralysis.

Born in New York, Jan. 10, 1841, he was descended from a distinguished Scotch family which figured prominently during the reign of Henry VIII. He was educated at the Brooklyn Polytechnic Institute and later entered as an apprentice in the engineering works of James Binns, Brooklyn, where he received his practical training.

At the outbreak of the Civil War, he entered the navy as third-assistant engineer and served on board the "Michigan," the "Dakota" and other vessels; took part in several engagements, including the capture of Norfolk. Shortly after this, however, he contracted typhoid fever and was sent to the hospital at Key West.

In 1864, the "Wachusett," to which he was attached, was lying in the port of Bahia, Brazil, near the Confederate ship "Florida" and at a council held in the cabin it was proposed to ram the latter vessel, but an objection was raised on the ground that the shock would loosen the boilers, break the steam-pipe joints and scald everybody below on the "Wachusett." Melville met this objection by the quiet proposition to stay below alone and take his chances, and the scheme was adopted. In the attack, a cable jammed and an ineffective blow was struck, but the "Florida" was otherwise captured and Melville was put on board of her to act as chief engineer.

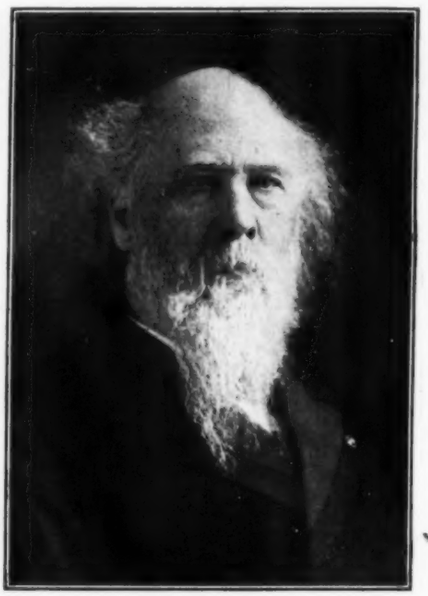
After a period of several years spent on various ships of the navy, Melville became associated with a series of arctic relief expeditions which were destined to make him an international figure.

The "Jeanette" expedition through Bering Straits was equipped for the government in 1879 with funds supplied chiefly by James Gordon Bennett, of the *New York Herald*. Lieutenant De Long was selected to command the expedition and Melville was chosen as chief engineer. From the start at San Francisco, Melville seems to have been the main reliance of De Long, whose reports resound with his praise, and are so much occupied with his mechanical contrivances that, as the commander himself remarked, "they look more like an engineer's notebook than a seaman's log."

Soon after passing through Bering Straits, the "Jeanette" was caught in the ice pack, where she was held for nearly two years, drifting 500 miles to the northwest. On June 11, 1881, the "Jeanette" sank, her crew being forced to escape on foot over the ice toward the Siberian coast, a distance of 500 miles, the nearest intervening island being 150 miles away.

The party became separated and Melville finally reached land. He immediately collected such supplies as northern Siberia afforded and turned back into the winter night to search for De Long's party, two scouts from which had met him. His only companions were two Yakuts. The windings of the retreat from the "Jeanette" had aggregated 2200 miles; now, with hardly any intervening rest, Melville's devotion to duty led him 1100 miles more and this under conditions of season and preparation which rendered his exploits practically unprecedented. He found traces of De Long, but lost the trail and thus was compelled to return.

Even this was not the end of his efforts, for January found him northward bound again, with better equipment. At last he discovered the corpses of De Long and others and buried them on a high point of land, building over their graves a cairn with a timber cross, which tomb has been reproduced in granite and marble at Annapolis, where the bodies now repose.



GEORGE W. MELVILLE

For his gallant work in connection with the Greely relief expedition in 1883-84, Melville was awarded a gold medal by Congress and was advanced 15 numbers in rank, soon being detailed as chief engineer of the navy.

Admiral Melville did not tarry about making such innovations in naval design as his good judgment dictated. One of the first was to get rid of the notion that engines must be horizontal, so that they could be stowed down in the hold where nobody wanted to put anything else. His initial venture with vertical engines was upon the "Maine."

He was the first engineer-in-chief of any navy to come out distinctly and strongly as an advocate of water-tube boilers for large vessels and, moreover, was the first naval engineer to secure accurate data upon the coal consumption in forced-draft trials. He also introduced the standardized screw as a method of determining speed trials, and credit is due to him for the first series of experimental data on the use of steam jets for forced draft.

One of Melville's greatest successes early in the building of the new navy was the 20,000-hp. cruiser "Columbia," built in 1890. In her construction, Admiral Melville, against the urgent advice of friends, risked his professional reputation to provide triple screws. When designed, this ship had larger machinery that that of any afloat. She crossed the ocean from Southampton to Sandy Hook in less than seven days, greatly reducing the existing warship records for a transatlantic passage and bettering, by at least a day, the expectations of her designer and builder. Even this speed record was soon broken by her sister ship the "Minneapolis."

Foreign nations, England not included, followed the lead and made extensive use of triple screws, but for some reason which has never been explained, the admiral's desire to continue the policy of putting them in was negatived by the Navy Department.

How far Melville was ahead of the general naval mind, can be inferred from nought" type as long ago as 1899. Furnought" type as long age as 1899. Furthermore, his resourcefulness was exhibited during the war with Spain in the construction of the repair ship and the water-distilling ship.

One of the remarkable characteristics of Admiral Melville, which enabled him to perform such an immense amount of work, was his quality of inspiring admiration, respect and loyalty in his subordinates. No chief ever possessed more completely the confidence and devotion of those under him.

Under the rule of retirement at 62 years of age, he passed out of office in August, 1903, at the end of his third term and sixteenth year as engineer-in-chief of the navy. So long a tenure of office by a bureau chief was probably unprecedented in the navy. He was then as active, mentally and physically, as most men are at fifty.

Admiral Melville later resided in Philadelphia, which had been his home before his service in Washington, and was the recipient of distinguished professional honor. In 1896 he received from Stevens Institute of Technology the degree of doctor of engineering, an honor rarely granted by that institution.

As president of the American Society of Mechanical Engineers, he had already served the term of 1898-1899, and when the society met in Washington in May, 1909, a session was spent in witnessing the presentation of his portrait, painted by Ivanowski, to the National Gallery.

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During 1911, 1,358,200 copies. For February, 1912 (American weekly, American monthly, English weekly and German weekly), total, 116,500.

Of this issue, 21,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 153

American Machinist

The Simple Lathe

In an article in this issue, a contributor makes a plea for a simple lathe. He asks if someone will not design, build, test and try out on regular machine-shop work a lathe as simple as can be developed and of a rugged, massive construction.

The elements and features of such a machine are listed and investigated to see if any of them are impracticable. The conclusion is reached that they are not from a mechanical viewpoint. With this conclusion we agree.

A question is then raised if commercial considerations render the proposal impracticable. The correspondent does not attempt to answer this query.

The first commercial objection that will be urged against a simple lathe is that it cannot be sold. The users of lathes expect to have such-and-such attachments—the ones they have always had—and continue to want them when buying. It does not matter if many of the attachments are not used. The buyer will readily admit that he will seldom, if ever, use some of them. He will also admit that he has other machines in his equipment that could be used for the few special jobs, thus making the machines about to be purchased as serviceable without a number of their devices as with. But on the other hand he will say, that if he wants to sell these machines after a few years of use, his prospective customer will want everything that goes with a lathe, and will not buy a simplified design. It is more than likely that the buyer of second-hand machines needs most of the attachments and devices regularly furnished.

To sum up, a second-hand lathe is not considered marketable unless complete.

This commercial argument against a simplified machine, though apparently conclusive, is really fallacious. It is based on the assumption that the purchaser of a machine tool is influenced in his selection by the probable second-hand value of that machine at some future date. That is, it is bought with a view to its value as an inventory asset, rather than its producing value as a unit of the shop equipment.

A machine tool should be selected for the latter reason, not for the former. We are continually hearing about the importance of output, product, results. We say that these things are all important. Then to be consistent we should give our greatest amount of consideration to what a machine will do, what it will produce, what results it will give. Its second-hand value at the end of five or ten or twenty years, should be given no weight whatever. If we are skeptical about this future value, increase the per cent. of depreciation, and make the machine "make good" against that additional odds.

A second commercial objection that may be urged against an innovation—as a really simple lathe would be—is the difficulty of making a place for it in the market. Missionary work is needed to bring out any new machine. It takes time and effort to present its advantages to prospective buyers. The marketing of a standard machine is far easier.

However, if the machine has real merit, if it can produce results, if it can turn out satisfactory work at a lower cost than its competitors, then it will find its place. Numerous instances can be mentioned to support this statement.

Our contributor sums up four advantages for the simple lathe as he believes it might be built. Should they materialize—and we see nothing to the contrary—such a machine would eventually find its place.

We should welcome the building and testing of such a machine. It has been our privilege to see numerous specialized machine tools, which have given astonishing results in producing work and cutting costs. Thus it seems as if this experiment was well worth the effort. But it should not be a half-hearted trial, but a sincere attempt to find out what there is in the proposal. We are willing to hazard a guess that the results would spell success.

Measurement of Screw Threads

Screws and taps are so commonly used in all machine construction that it sometimes seems as though we had entirely overlooked their importance, and the part they play in machine production of almost every kind.

While the work of the Franklin Institute was fairly successful in establishing what we now know as the U. S. S., not only for the form of thread, but also for the number of threads per inch on bolts of different sizes, there is still much to be done along this line. Even today, in spite of the demand for finer threads than those given by the U. S. S. list, we find many half-inch bolts being made with 12 instead of 13 threads, as prescribed. There can be no argument in its favor, and there is every reason for adopting the prescribed standard, simply for the reason that it is standard if nothing else.

But leaving this entirely out of the question, we are confronted with the somewhat startling proposition that in most cases we have no accurate method of measuring screws or taps. Manufacturers who use thousands of machine screws and bolts know to their sorrow the difficulty of securing interchangeability, and the time wasted in assembling work, where the screws either fit so loosely as to be objectionable, or refuse to go in the tapped holes.

We have long known that the proper way of measuring screw threads was in the angle of the thread, on what is known as the pitch diameter, in a similar way to the plan used in gearing. But there are few plants equipped for measuring screws in this way, and until this is recognized and followed out, we must expect troubles of this kind.

There can be no question but that the plan of measuring outside diameters of screws and taps must be abandoned for the method which considers the pitch diameter, the angle of the thread and the lead, if we are to have anything like satisfaction in assembling.

Possibly the question of lead is of less importance than the other two in most manufacturing, for the simple reason that the tapped hole is usually compara-

tively short. The question of pitch diameter, however, and the angle of the sides of the thread are of vital importance where a good fit is desired.

There is still much work to be done along this line in the determination of practical limits of errors for both taps and screws, as it must be remembered that the minimum tap must be larger than the maximum screw, and yet that if this limit is too large, the minimum-size screw will be too loose in a hole tapped by the maximum tap.

Workmen's Compensation

At the recent convention of the National Civic Federation, the position of the organization on workmen's compensation was reaffirmed in these words: "The Federation stands squarely committed to compulsory compensation, without alternative remedies, to the fullest extent that such a condition can be secured."

Meanwhile, forty-eight state legislatures represent as many laboratories where theories and laws are being compounded, and forty-eight states represent as many fields for the trying out of these theories when crystallized into law.

Does not this indicate a waste of legislative and experimental energy? Is such lack of uniformity defensible?

New Publications

MARINE STEAM TURBINES. By G. Bauer and O. Lasche, assisted by E. Ludwig and H. Vogel. Translated from the German and edited by M. G. S. Swallow. Cloth, 214 6x9½-in. pages; 103 text illustrations, 18 tables, folding chart in pocket of cover; indexed. The Norman W. Henley Publishing Co., New York City. Price, $3.50.

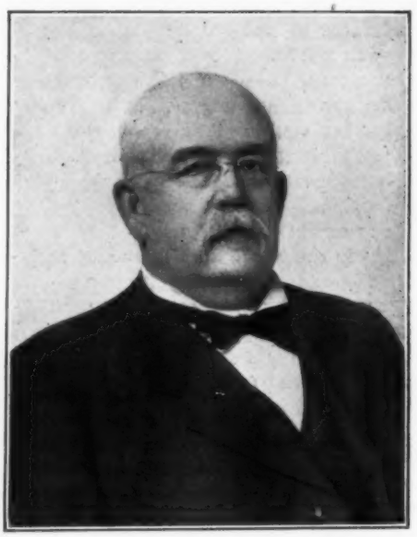
This book fills a gap in steam-turbine literature and is undoubtedly the most satisfactory work yet published on the subject. The introductory chapter deals with the advantages of steam turbines compared with reciprocating-engine installations, and in a general way with the subjects of steam consumption, weight, space, vibration, maneuvering, maintenance and repairs. Part II takes up the general features of design of a turbine installation; part III treats of calculations; part IV of designs; part V of shafting and propellers; part VI of condensing plants; part VII of arrangement of turbines; part VIII general remarks on arrangement of steam turbines in steamers; part IX turbine-driven auxiliaries, and part X comprises a few useful tables.

The first four parts deal with the design of turbines of the Parsons and so called A. E. G. type, which is a combination of Parsons and Curtis. The language used is clear and easily understood. The reasoning leading to the derivation of formulas is simple. These two features increase the value of the work both as a textbook and for reference. The numerous figured examples are worthy of comment as an additional useful feature.

Henry Wilson Spangler

Dr. Henry Wilson Spangler, for twenty years head of the mechanical engineering department of the University of Pennsylvania, died, Mar. 18, after a long illness. He was born at Carlisle, Penn., Jan. 18, 1858. He entered the U. S. Naval Academy and graduated therefrom in 1878, receiving from the University of Pennsylvania the honorary degree of M.S. This class was one of the first of regular engineers educated by the government and at that time was looked upon somewhat as an experiment.

Prof. Spangler remained in the engineer corps of the navy up to 1889. At the special request of the University of Pennsylvania he was appointed by the government instructor in mechanical engineering, from 1881 to 1884 and again from 1887 to 1889. In 1890 he was made full professor of mechanical and electrical engineering, having received the title of assistant professor in 1883. In 1893 he was a member of the Advisory Counsel of the Engineering Congress of the Columbian Exposition. He was also a member of the Jury of Awards for the Pan-American Exposition in 1901. Prof. Spangler was also a member of the Franklin Institute, the American Society of Mechanical Engineers, American Society of Naval Architects and Marine Engineers, and of the Engineers Club of Philadelphia. He was president of the latter in 1890.



HENRY WILSON SPANGLER

Not only did he lay stress in his work upon the actual education of students along practical lines, but he always kept in mind the greater educational value of the development of the character. This idea was a guiding principle in all his educational work. Prof. Spangler was a co-author of the "Elements of Steam Engineering" and the author of "Notes on Thermodynamics." In this latter book he set forth the principles of this rather difficult subject in remarkably clear and concise form.

The honorary degree of Doctor of Science was conferred upon him in 1906 at the dedication of the splendidly equipped engineering laboratory of the University of Pennsylvania, in the planning and erection of which he was the leading spirit.

Personals

Charles A. Trask has resigned his position as chief engineer and works manager of the Cartercar Co., Pontiac, Mich.

R. B. Coleman has been made general manager of the Georgia, Florida & Alabama Ry., with headquarters at Bainbridge, Ga.

J. J. Voelcker, machine-shop foreman for the H. Mueller Manufacturing Co., Decatur, Ill., was recently elected president of their Foremen's Club.

John Weise, formerly superintendent of the boiler department of the Canada Foundry Co., Toronto, Can., has resigned to take a similar position with the Gem City Boiler Works, Dayton, Ohio.

Albert W. Howe, who formerly looked after the interests of the Standard Plunger Elevator Co., in New York City, has become sales manager of the Bishop Calculating Recorder Co., New York City.

H. E. Chellis is no longer connected with the H. E. Chellis Machine Screw Co., Springfield, Mass., having accepted a position with the Union Petroleum Co., and will act as Boston representative of the mineral lard oil department.

G. B. Massey, for the past four years resident engineer of the Bucyrus Co., South Milwaukee, Wis., in charge of the New York office, has been transferred to the home office, prior to an extended European trip in the interests of his company.

C. G. Turner, of the American Machinery Co., has been made vice-president of the Southern Saw & Machinery Works, Atlanta, Ga., which firm is now parent of the holding companies of which Edward L. Humphreys is vice-president and general manager.

A National Commercial Organization

The date for the conference to discuss the establishment of a national commercial organization, the aims and objects of which were outlined in this page last week, has been advanced one week and will be held at the Hotel Williard, Washington, D. C., on April 22 next. The meeting has been deferred in order to assure adequate hotel accommodations for the delegates.

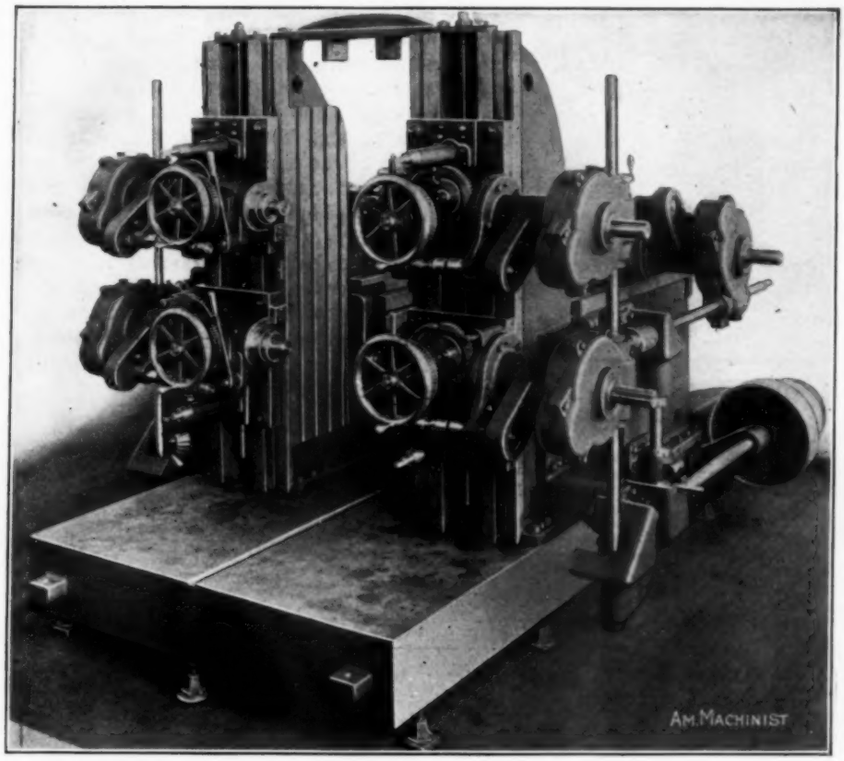
Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Reaming and Boring Machine

The halftone shows a machine built by the Beaman & Smith Co., Providence, R. I., for reaming and boring heater sections.

The platen supports two uprights, on each of which are two adjustable saddles, each carrying a spindle. At the rear are two horizontal beds, on each of which is a saddle carrying a spindle. The platen is 6 ft. wide, 10 ft. long, 12 in. high and is provided with a track on which a jig holding the work is rolled into position. Two jigs are required, so that one can be loaded or unloaded while the other is in the machine.



A Reaming and Boring Machine

The spindles are of crucible steel, and run in hard-bronze boxes, the front one 3 in. in diameter and 6 in. long. The spindles on each upright are driven in unison, those on the beds are independent. All spindles have a horizontal movement of 11 in. in their respective heads. There are four speeds, ranging from 15½ to 32 r.p.m.

The feeds for the spindles are automatic, from $^1/_{64}$ to $^1/_{32}$ in. per revolution of the spindle, and are obtained by changing gears. The power is transmitted by two 5-in. belts on two 4-section cones from 14 to 20 in. in diameter, through gearing in the ratio of 14 to 1. On each side of the machine are three spindles driven independently.

The distance between uprights is 23½ in. The least distance between the centers of spindles on the uprights is 18 in.; the greatest is 49 in. from the center of the lower spindle to the top of the platen; the least is 15¾ in. The least distance between the ends is ¾ in.; the greatest is 22¾ in. From the centers of spindles on the uprights to the center of the rear spindles the least distance is 36 in.; the greatest is 62 in.; from the center of the rear spindles to the top of the platen is 40¼ inches.

The countershafts have tight and loose pulleys 14 in. in diameter for a 7-in. belt. The weight is approximately 31,000 lb.

Scraping Table

The scraping table shown herewith has a base 24 in. in diameter, and a flat top 16x30 in., with three ⅝-in. standard T-slots.

It has a vertical adjustment of 6 in., bringing the top surface from 28½ to 34½ in. from the floor. It may be swung throughout the entire 360 deg. and tilted 90 deg. on either side of the horizontal, so as to bring the surface to be scraped just where it is wanted to take advantage of the light and most comfortable position, and held there rigidly. The top lowers or raises by turning and has a safety limiting stop. Tilting the table brings angular surfaces, as on gibs, where they can easily be reached. The tilting lever telescopes under the table and can be used on either side. All the settings are made with drop-forged double-set handles readily reached from either side.

Scraping Table

This table is a recent product of the New Britain Machine Co., New Britain, Conn.

A Tap Wrench

The tap wrench shown herewith requires little explanation so far as design and construction are concerned.

Tap Wrench

The tool is a recent product of the Milliken Machine Works, West Newton, Mass.

Cam Feed Drilling Machine

A front view of a four-spindle and a rear view of a six-spindle automatic drilling machine built by the Dwight Slate Machine Co., Hartford, Conn., are shown in Figs. 1 and 2 respectively.

The automatic feed of each spindle is controlled by a separate cam mounted on a shaft at the rear of the machine. These cams are so mounted that they can be set to feed either simultaneously or each independent of the other.

The cams are so formed that they approximately duplicate the performance of an expert hand operator. Each spindle has three speeds and is driven by an independent endless belt from the shaft at the rear of the machine. This shaft also drives the cam shaft through worm gears and the speed box, shown to the right in Fig. 2, which gives three gradations of feed for each of the three spindle speeds.

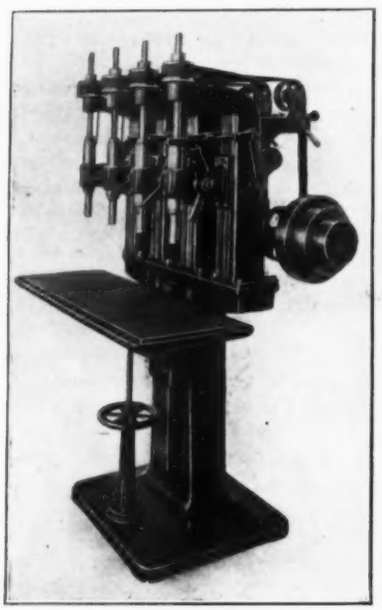
The cut, Fig. 3, shows one form of automatic feed and trip. The cam is shown at *A* and the cam roller at *B*. The lever *C*, on which the cam roller is mounted, is slotted as shown to permit the adjustment of the connecting rod *D*. This adjustment alters the traverse of the spindle.

Mounted on the quill bracket *E* is a lever *F* provided with a pin *G* over which the outer end of the connecting rod *D* is hooked. The lever *F* is also provided with a friction trip *H* which automatically operates should the feed be excessive. A spring, backed by an adjusting screw, permits the trip to be set to suit conditions.

The total travel obtainable is 1½ in. The automatic release eliminates a large amount of drill breakage due to hard spots in castings and dulling of the drills. The hook on the connecting rod *D* permits the tripping of the feed by the operator at any point, and the lever *I* permits the movement of the spindle independently of the automatic feed.

Another form of automatic feed and trip is shown in Fig. 4.

The worm *F* is supported and held in engagement with the worm gear *R* by means of the latch arm *A* resting on the supporting stud *I*. The adjustment of the automatic knock-off for any depth of feed between 0 and 5¼ inches is obtained by locating and fastening the ring *B* to rotate with the pinion shaft *L*, and at a position with respect to the depth of feed desired, which will allow the projection on the ring *B* to travel the distance necessary to disengage the latch arm *A* and the supporting stud *I*. The screw *N* and shoe *K* provide convenient means for securely locking the ring *B* to the shaft *L*. The stop pin *P* determines the maximum adjustment to the ring *B*.



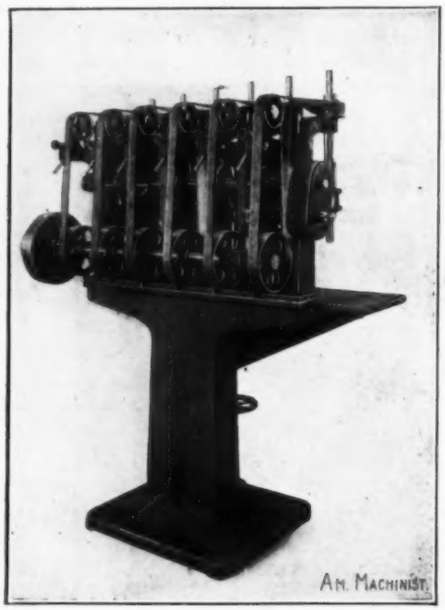


FIG. 1 FRONT AND REAR VIEW OF AUTOMATIC-FEED DRILLER FIG. 2

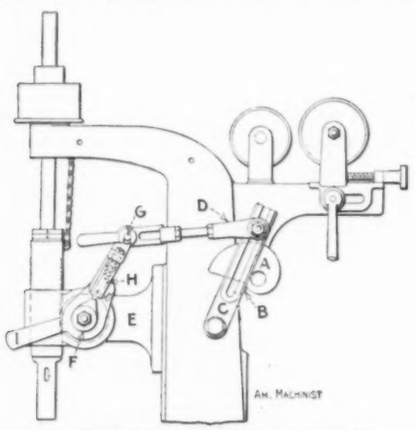


FIG. 3. AUTOMATIC FEED AND TRIP

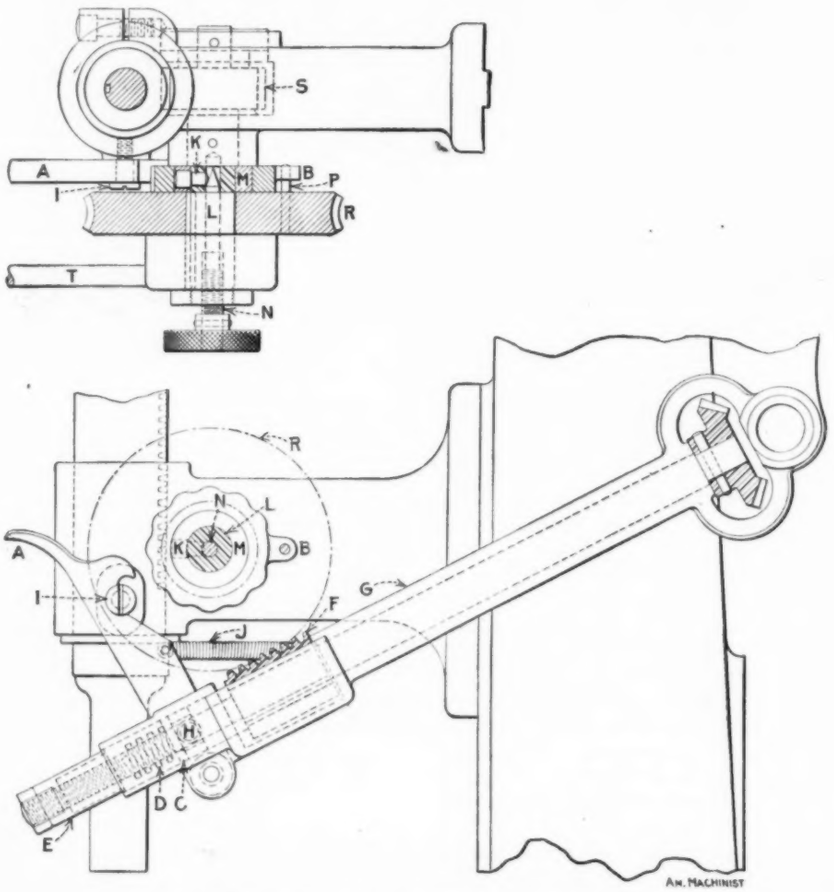


FIG. 4. ANOTHER FORM OF AUTOMATIC FEED AND TRIP

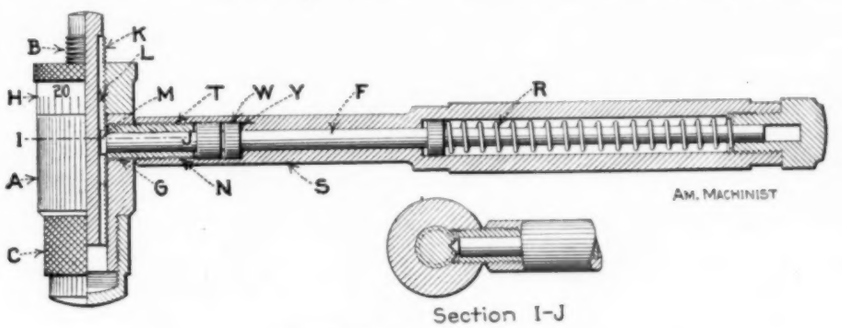
The automatic safety release operates in the following manner:

The worm *F* is keyed to rotate with its shaft but is free to slide longitudinally. Under normal load the worm *F* is held in operative position with respect to the worm gear *R* by means of the ring *C* and the compression spring *D*. When overload occurs the compression spring *D* will yield, allowing the worm *F* to slide sufficiently to force the ring *C* carrying the pin *H* to disengage the latch arm *A* from the supporting pin *I*. Adjustment for tension of the compression spring *D*, to suit different sizes of drills, is made by the cap *E* and the locking nut as shown.

The feed may be stopped at any time by throwing out the latch *A*, or may be started by lifting the wormshaft supporting the arm *G*, when the latch *A* will fall into position on the supporting stud *I* actuated by the tension spring *J*.

Inside Micrometer

The cut shows an inside micrometer recently developed by the J. T. Slocomb Co., Providence, R. I., and made in sets of two—one for measuring internal dimensions from ½ to 1 in., and the other from 1 to 2 in.



INSIDE MICROMETER CALIPER

It is graduated to read direct in thousandths of an inch, and is especially useful for measuring throughout the entire depth of a hole.

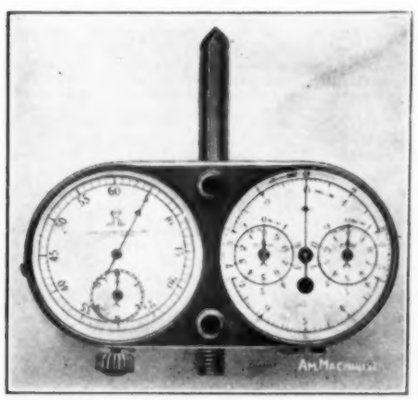
The barrel or body of the instrument *A* holds the measuring screw *B*, which telescopes as indicated. The measuring screw is advanced from the barrel by the nut *H*. An adjusting cap *C* fits on the barrel *A* and is capable of slight adjustment to compensate for wear. The measuring screw is prevented from rotating when being advanced by the nut by means of the spindle *F* having a V-point *M* and held in position at the side of the barrel by the bushing *N*, which is threaded into the barrel at *G*. This V-point meshes into a slot in the measuring screw, and is brought to bear on the measuring screw by means of the spring *R* held in the chamber of the handle *S*, which handle is threaded on the bushing *N* at *T*. After an adjustment has been made, the measuring screw is locked into position by a right-hand rotation of the handle, which causes the shoulder at *Y* to bear on the collar *W*, which presses the spindle against the slot in the screw.

There are two screws for each micrometer, which are fitted with individual nuts. The range of the short screw for the small micrometer is from ½ to ¾ in. The range of the long screw for the small micrometer is from ¾ to 1 in. The range of the short screw for the large micrometer is from 1 to 1½ in. The range of the long screw for the large micrometer is from 1½ to 2 in.

Counter and Stop Watch

The halftone shows a revolution counter and precision nonmagnetic stop watch, so connected that they will simultaneously start to work the moment a slight pressure is applied to the center spindle. As soon as the pressure is released, both the counter and watch stop, thus indicating on dials the number of revolutions made by the object under test and the elapsed time.

The instrument can be used for any rotating shaft or spindle up to 30,000 turns per minute. The duration of the test is indicated in minutes, seconds, and fractions thereof. The small pointer on the watch dial records up to 30 minutes and then repeats.



REVOLUTION COUNTER AND STOP WATCH

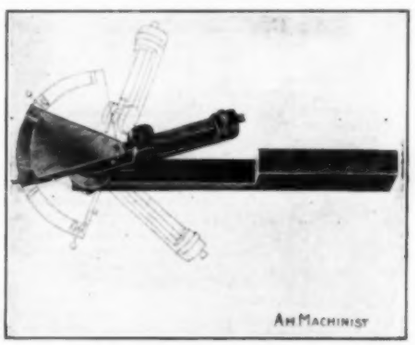
The revolution counter has three dials which indicate from 1 to 100, 100 to 1000, 1000 to 10,000 revolutions per minute, respectively. The instrument is equally useful for right- or left-hand revolutions. It can be applied to the shaft to be tested without previous knowledge of the direction of movements. No adjusting or setting is required. The appearance of either a red or black disk on the counter dial, shown as a black spot on the cut, indicates whether the shaft is turning right- or left-hand. The figures on the dial, which correspond in color to the disk, are to be used. The counter as well as the stop watch can be set back to zero instantly.

This instrument is manufactured by Schuchardt & Schütte, 90 West St., New York City.

A Test Indicator for Close Readings

The illustration shows a new type of test indicator recently developed for use on lathes, millers and in toolroom work. It is shown ready for use in the ordinary tool post.

The instrument proper is very light and sensitive, having a scale with graduations reading one-half thousandths on one-eighth-in. spacings; therefore, a reading of one-tenth thousandth inch can be obtained.



TEST INDICATOR FOR CLOSE READINGS

As the tool is mounted on an adjustable holder, it can be set in any direction and positioned for its work by the adjusting nut at the end of the tool, and by an elevating nut can be raised or lowered to align with the center line of the lathe. When removed from the holder, the stem fits the tool post of any bench lathe, or can be clamped to the spindle of a surface gage in place of the scratch awl.

Contact with the work is made direct on the end of the ball, and by a system of levers gives a reading on the scale multiplied about 200 times. These contact points are removable, and can be replaced by fine points, flats, or any special shape or form required. The working parts are all protected from possible injury by the metal shield.

The indicator is a recent product of the American Watch Tool Co., Waltham, Mass.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

The Randall-Faichney Co., 251 Causeway St., Boston, Mass., has purchased a site on which to erect a four-story factory for the manufacture of light metal and brass accessories.

The Kissel Motor Kar Co., Hartford, Wis., is planning to erect a two-story garage and salesroom, at Boston, Mass., to take care of the New England States trade. Motor driven machinery and appliances will be installed.

The contract for the factory building to be erected in East Springfield, Mass., for the Stevens-Duryea Automobile Co., Chicopee, Mass., has been awarded. It will be 80x508 ft., four stories high, of brick and steel. The F. W. Dean Corporation, 53 State St., Boston, are the architects.

H. L. Sprague, 310 Main St., Springfield, Mass., is revising plans for the erection of the proposed addition to the plant of the Moore Drop Forging Co., on Birnie Ave., Springfield. The new plans provide for a two-story brick addition 45x132 ft., of heavy mill construction.

Ford, Buck & Sheldon, Inc., engineers, are preparing plans for the erection of a factory building, on Capitol Ave., by the Pope Manufacturing Co., 436 Capitol Ave., Hartford, Conn. It will be about 70x193 ft., four stories high, of reinforced concrete. Plans will be completed soon.

The general contract has been awarded for the factory building at Booth and Orange Sts., New Britain, Conn., for the Hart & Cooley Co., manufacturer of wrought steel and hot-air registers. It will be 45x123 ft., two stories high.

Estimates have been submitted for changes to the car barn on Grand Ave., New Haven, Conn., for the Connecticut Co., Union and Fair Sts., New Haven. Estimated cost, about $14,000.

The Winchester Repeating Arms Co., 195 Winchester Ave., New Haven, Conn., is planning to erect a large shot tower, 56x90 ft., and 120 ft. high, on Division St., New Haven.

E. T. Hall, Riverside, Conn., will erect a 1½-story garage and stable, to cost $5000. Barnard & Wilder, New Rochelle, N. Y., are the architects.

The contract has been awarded for the addition and alterations to the shop and office of Henry Weyand Co., Inc., makers of galvanized iron, etc., on Jefferson St., Waterbury, Conn. The new part will be 40x80 ft., three stories high, of brick, granite and limestone trim. Freney & Jackson are architects.

MIDDLE ATLANTIC STATES

The Erie R.R. Co. will spend $20,000 improving the shops of the Rochester Division, at Avon, N. Y., this spring. R. Gunn, Buffalo, N. Y., is superintendent of car shops.

The Empire Metal & Steel Plant, Fort Plain, N. Y., will establish a factory, at Bolivar, N. Y.

The Empire Lime & Stone Co., Buffalo, N. Y., has had plans completed by R. J. Reidpath & Sons, architects, for a machine shop and office building at Hudson St. and Erie Canal, of stone and brick construction. Bids are being received by the architects.

The Doehler Die Casting Co., Court and Ninth Sts., Brooklyn, N. Y., manufacturer of finished metal castings, will erect an addition to its present plant. It will be seven stories high, 50x100 ft., of reinforced concrete. H. H. Doehler is president and general manager.

The Simplex Co., Long Island City, N. Y., is planning the construction of a one-story automobile factory building, 100x200 ft., at a cost of $40,000.

The A. L. Swett Iron Works, Medina, N. Y., is having plans prepared for a modern factory building of about 35,000 sq.ft. floor capacity. The equipment to be installed will include traveling and jib cranes, a 64-in. cupola, new core ovens and equipment for same. The company also contemplates the erection later on of a tumbler building with requisite equipment of tumbling machines, also sand-blast and exhaust system. Noted Feb. 22.

The General Electric Co., Schenectady, N. Y., has begun work on the foundations for a three-story concrete shop building, 80x300 ft. Noted Mar. 21.

The Savage Arms Co., Utica, N. Y., will erect a new building and install machinery to take care of its increased production of fire arms.

Joseph Arbiter, 44 Prospect St., Yonkers, N. Y., will erect a one-story garage, 24x20 ft., to cost $3000. W. P. Katz, Yonkers, is architect.

Fire destroyed the engine and boiler house of George J. Gould, at Georgian Court, Lakewood, N. J.

The Saurer Motor Co., Plainfield, N. J., is receiving bids for the construction of a one-story automobile building, 83x99 ft.

M. R. Trimble, architect, Ferguson Building, Pittsburg, Penn., is preparing plans for a garage to be erected at Edgeworth, Penn.

Lambert's Garage, 714 Myrtle St., Erie, Penn., was destroyed by fire, Mar. 11. Loss, $1000.

The carriage and automobile building shops of George Lenhart, with four other buildings used as paint shops or for wheelwrighting or machine purposes, at Maple Glen, Penn., were destroyed by fire, Mar. 16. Loss, $40,000, partially covered by insurance.

A garage will be erected in Merion, Penn., by Mrs. H. C. Carwithem, care of C. B. Keen, architect, Bailey Building, Philadelphia, Penn.

The garage of Charles Strause, 6508 Ridge Ave., Philadelphia, Penn., was damaged by fire, Mar. 17. Loss, $500.

W. B. Klee, 1505 Shady Ave., East End, Pittsburg, Penn., will erect a garage.

The automobile garage of Robert King, on North Negley Ave., Pittsburg, Penn., was damaged by fire, Mar. 15. Loss, $500.

Nathaniel Spear, care of E. B. Lee, architect, People's Bank Building, Pittsburg, Penn., will erect a garage.

The garage of the Manchester Automobile Co., at Fayette and Chartiers Sts., Pittsburg, Penn., was destroyed by fire. The building loss was $30,000, and $50,000 of automobiles were destroyed.

C. F. Owsley, Dollar Bank Building, Youngstown, Ohio, is preparing plans for the erection of a garage at Sharon, Penn.

A garage will be erected by C. M. Stieff, Aiken and LaFayette Aves., Baltimore, Md.

A. D. Foster, 920 Equitable Building, Baltimore, Md., will erect a one-story garage to cost $3000.

The Callahan, Atkinson Co., 328 North Charles St., Baltimore, Md., will erect a two-story garage.

Robert Garrett, Continental Building, Baltimore, Md., will erect a 1½-story garage to cost $5000.

The repair shop of the Terminal Taxicab Co., 1231 Twentieth St., Washington, D. C., was damaged by fire, Mar. 17. Loss, $11,500.

H. R. Stanford, Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contracts for the construction and equipment of a foundry building for the Washington Navy Yard.

SOUTHERN STATES

The Gulf Iron Works, Tampa, Fla., is having plans prepared for the construction of a machine shop, 50x100 ft. F. J. Kennard is the architect.

The Walsh & Weidner Boiler Co., Chattanooga, Tenn., will erect a new shop building. It will be 90x150 ft., of steel construction.

The Elkton Machine Works, Elkton, Ky., will receive bids until May 1, for the construction of a fireproof machine shop, 60x100 ft. N. P. Blankenship is manager.

MIDDLE WEST

The Loew Manufacturing Co., 9100 Madison Ave., Cleveland, Ohio, maker of hardware specialties, has increased its capital to $400,000. New machine tools and other equipment will be needed for shops.

A garage will be built by A. N. Barrow on 1912 East Seventy-first St., Cleveland, Ohio.

The Cleveland Automatic Clock Co., Cleveland, Ohio, has been incorporated to make a new automatic system of clocks by H. P. Shupe, C. A. Bond and others with $250,000 capital. Complete machine-shop equipment for light work will be purchased.

The National Screw & Tack Co., Stanton Ave. and East Seventy-fifth St., Cleveland, Ohio, has had plans prepared for the construction of a new factory on Stanton Ave. It will be five stories high, 37x50 ft., of brick and steel.

Plans have been prepared for the erection of a new factory, on River St., Cleveland, Ohio, for the Ohio Machine & Boiler Co., River St. It will be one story, of brick and steel.

Turbines to the amount of $200,000 will be purchased by the City of Cleveland, Ohio. W. S. Callan is purchasing agent.

The La Belle Iron Works Co., Steubenville, Ohio, plan to take over the works of the Phillips Sheet & Tin Plate Co., of Clarksburg, W. Va., and install new equipment.

The Foss Gas Engine Co., Springfield, Ohio, maker of gas engines, will install new machine tools at its factory and make other improvements.

Julian Kennedy, consulting engineer, Bessemer Building, Pittsburg, Penn., is preparing plans for the construction of a new mill for the Brier Hill Steel Co., Youngstown, Ohio. Eight open-hearth furnaces will be installed and the capacity of the plant will be increased to 2000 tons a day.

P. J. Collins, Youngstown, Ohio, is having plans prepared for the construction of a garage. It will be two stories, 40x80 ft. C. F. Owsley, Dollar Bank Building, is the architect.

Fire destroyed the brass and aluminum foundry of the Sterling Machine & Stamping Co., at Wellington, Ohio. The company makes automobile accessories and suction sweepers. The plant will be rebuilt and new machine equipment purchased.

The Automatic Pin Ticketing Co., Dayton, Ohio, will buy new machine-shop tools for its factory.

The R-C-H Corporation, Detroit, Mich., has completed negotiations for the lease of the factory buildings on Monroe Ave., formerly occupied by the Herbert Manufacturing Co. This additional space will enable the company not only to increase the output of the Hupp-Yeats electric cars, which were formerly made at the R-C-H plant, but also to double its output of R-C-H gasoline cars.

The Aluminum Castings Co., F. C. Root, manager, Chene and Finlay Sts., Detroit, Mich., has awarded contracts for its new factory.

The Murphy Potter Co., 364 Trombley Ave., Detroit, Mich., manufacturer of brass specialties and auto parts, will erect a new plant. Machine equipment will be needed.

The Kelsey Wheel Co., 1208 Military Ave., Detroit, Mich., manufacturer of auto wheels, are erecting two new factories and a dry kiln.

The Panwood Starter Co., Grand Rapids, Mich., will shortly have a factory in operation at 120 Court St., where the work of assembling the parts, which will continue to be manufactured at the Wonter & Stryker shop, will be carried on. The company manufactures the Panwood starter.

The Decatur Motor Car Co., Cambridge, Mass., will establish a plant in Grand Rapids, Mich., and will be known hereafter as the Grand Rapids Motor Truck Co., manufacturer of the Decatur truck. The new company is capitalized at $600,000.

The Joliet Bridge & Iron Co., Joliet, Ill., has begun the erection of a pattern shop, 40x100 ft., for which new machinery is being purchased.

The Elgin Automatic Sewing Machine Co., Elgin, Ill., has been organized for the equipment of a plant for the manufacture of machines. The incorporators are R. H. Rudolph, George Knolbach and A. C. Moreland.

The Emerson-Brantingham Co., Rockford, Ill., is preparing plans for the erection of a new foundry of steel and concrete construction.

Patterson & Davidson, constructing engineers, 1448 Monadnock Block, Chicago, Ill., are designing a new foundry and warehouse for the Home Stove Works, 2262 West 18th St. The foundry will be 136x166 ft., and the warehouse 92x205 ft., each four stories high, of fireproof construction.

Robert M. Hyde, architect, 218 South La Salle St., Chicago, Ill., is preparing plans for the construction of a two-story and basement factory, 96x125 ft., for the Howard Electric Co. The estimated cost is $12,000.

The Janesville Motor Car Co., Janesville, Wis., is constructing a garage and salesroom on Court St.

WEST OF THE MISSISSIPPI

The Whitney Loan & Trust Co., Atlantic, Iowa, will erect a one-story garage, 22x30 ft. F. D. Willis, Omaha, Neb., is architect.

The H. Kohrs Packing Co., Davenport, Iowa, will erect a one-story garage, 32x62 ft. Estimated cost, $5000. D. J. Harfat, Davenport, is architect.

The Western Implement & Motor Co., Davenport, Iowa, has completed plans and will immediately proceed to erect a large plant. J. F. Appiely is vice-president of the company.

Clayton E. Bronson, Waterloo, Iowa, will erect a two-story garage, 42x80 ft. Estimated cost, $7000. J. T. Burkett, Waterloo, is architect.

William Pedicard, architect, Waterloo, Iowa, is preparing plans for the erection of a two-story garage and repairing paint rooms, 60x140 ft. Estimated cost, $23,000.

The two-story brick garage of C. W. Gordon, 378 Summit Ave., Minneapolis, Minn., was destroyed by fire, Mar. 14.

The White Bear Automobile Co., St. Paul, Minn., is constructing a garage at Sixth and Exchange Sts., 90x150 ft., at a cost of $80,000. This same company is also negotiating for the garage of the Columbus Buggy Co.

A. Murphy & Son, 1410 Jackson St., Omaha, Neb., will erect a three-story automobile repair shop, 44x132 ft. Estimated cost, $15,000. J. E. Fietrick, Omaha, is architect.

Plans are being prepared by C. B. Sloan, architect, Kansas City, Mo., for the erection of a garage for N. D. Shelby, Fifty-fifth and Oak Sts., Kansas City.

Plans have been completed for the erection of a two-story and basement garage, 40x100 ft., for T. A. Swearingen, 4721 Troost Ave., Kansas City, Mo.

Helmuth & Helmuth, architects, Chemical Building, St. Louis, Mo., are receiving bids for the erection of a garage for Florence P. Hermann.

The Union Tool Co., Dominguez, Colo., has started the erection of a plant, to be completed this year. The main buildings will occupy 25 acres and will be of steel and concrete. There will be six structures, including an administration building. The assembly shops will be 25x100 ft., and the three shops in the rear of the assembly shop will be 100x250 ft. each. The estimated cost is $400,000. The entire plant will be connected by electric railway tracks on the surface and by overhead traveling cranes. The company has purchased an additional five-acre tract of the Dominguez Land Co., for the construction of a steel barrel factory. The cost will be $100,000.

WESTERN STATES

The Gilbert Hunt Co., Walla Walla, Wash., will build an addition to its machine shops.

The Southern Oregon Automobile Co., Klamath Falls, Ore., has recently opened a new garage, 60x150 ft., to be known as the White Pelican Garage.

The Southern Pacific Co. will soon commence the erection of modern car barns and shops at Oswego, Ore. The work is estimated to cost $128,000.

The "A" Auto Co. will install $30,000 worth of machinery in the factory buildings recently erected at Ardmore Heights, 11 miles north of Sacramento. E. C. Collins, of San Francisco, Calif., is president of the company.

J. A. Birch, Placerville, Calif., will build a modern garage and repair plant on Main St.

The Pittsburg Gas Stove Works will erect a stove-manufacturing plant, at Redding, Calif.

CANADA

The Napanee Iron Co., Ltd., Napanee, Ont., has been incorporated by John P. Vrooman, J. M. and T. B. Wallace and Edmund J. Roy, who contemplate the building and equipment of a plant. The company is capitalized at $200,000.

The workshop of the Martin Electric Co., St. Catharines, Ont., was destroyed by fire, Mar. 16. The loss is partly covered by insurance.

The McLaughlin Carriage & Motor Car Co., Vancouver, B. C., will erect a large commercial garage on Georgia St.

The Schaake Machine Co., New Westminster, B. C., is contemplating the erection of a new plant at Coquitlam, B. C.

The Canadian Northern Ry. Co. has issued a list covering its 1912 requirements of machine tools, on which bids are to be considered in the near future. The approximate cost of these tools will be $35,000. This list is as follows: One 80-in. drive-wheel lathe, complete with 220-volt direct-current motor and controller; one 42-in. double-head upright boring mill for boring tires; one hollow spindle turret lathe, capable of taking bars up to 6 in. diameter; one 24-in. upright shaper; one 14-in. upright slotting machine; one hollow spindle turret lathe, capable of taking bars up to 2¼ in. diameter; one 18-in. turret lathe; one 20-in. turret lathe; one 20-in. sensitive drill press; one 36-in. back-geared drill press; one 2-in. double-head bolt cutter; one 1½-in. triple-head bolt cutter; one Lassiter automatic staybolt drilling machine; one roller type tube-welding machine; one 1-in., 6-spindle, semiautomatic nut-tapping machine; one 24-in. planer; one 6-spindle vertical staybolt threader; one No. 8 Beaudry Champion power hammer; one No. 3 washer cutting machine; one 36-in. Bullard vertical turret lathe; one 24x36-in. by 14-ft. gas-engine lathe; two 24-in. column shapers; two 36-in. back-geared upright drill presses. E. Laugham, Winnipeg, Man., is purchasing agent.

GENERAL MANUFACTURING

NEW ENGLAND STATES

Thorndike & Hix, Union, Maine, have awarded the contract for rebuilding their cannery at Union. The main building will be 30x60 ft.

The mill of the Milton Leather Board Co., Milton, N. H., was destroyed by fire, Mar. 20. Loss, $100,000, partly covered by insurance.

Plans are being prepared by Monks & Johnson, architects and engineers, 7 Water St., Boston, for a coal-handling plant for the Metropolitan Coal Co., Chelsea, Mass. Estimated cost, $100,000.

The Water Commissioners of Gardner, Mass., will soon start improvements on the pumping station at Crystal Lake, including the installation of a new pump.

Bids are being received at the office of the Metropolis Water and Sewage Board, Ashburton Place, Boston, Mass., for the erection of the superstructure of the high-service pumping station. Engine and boiler-room equipment will be required. Information may be obtained from Dexter Brakett, chief engineer of the board.

The Parkhill Manufacturing Co., manufacturer of ginghams, will erect a new four-story mill, 100x137 ft., at its plant, at Fitchburg, Mass.

The plant of the Trafton Waist Co., Franklin St., Melrose, Mass., was damaged to the extent of $2000 by fire, Mar. 15.

A. P. Thompson, superintendent of the Hetburn Leather Co., Salem, Mass., is receiving bids for the erection of a new factory. It will be five stories high, 40x160 ft. Pitman & Brown, 248 Derby St., are the architects.

Samuel M. Green, architect, Springfield, Mass., has plans ready for estimates for an addition at the plant of the National Blank Book Co. The building will be 30x200 ft., five stories high, of brick and steel. Noted Mar. 14.

Bids are being received for the erection of additions to the plant of the Middletown Electric Light Co., Middletown, Conn. The company will install a new turbine engine equal to the capacity of the two engines now in use, and also add one or more boilers. The capital stock will be increased from $150,000 to $250,000.

Griggs & Hunt, architects, 51 Leavenworth St., Waterbury, Conn., are preparing plans for the new addition to the factory of the Hemingway & Bartlett Silk Co., in Watertown, Conn. It will be 40x80 ft., two stories, of wood and brick basement.

MIDDLE ATLANTIC STATES

Architects Esenwein & Johnson have completed plans for a one-story addition, 62x82 ft., to the plant of the Linde Air Products Co., Chandu and Grote Sts., Buffalo, N. Y.

Bids will be received until 2 p.m., Mar. 29, by George McAney, president borough of Manhattan, New York, N. Y., for the installation of electric-lighting system, fixtures and wiring complete in the Washington Market Building, borough Manhattan; and until 2 p.m., Apr. 1, for furnishing, putting in place and maintaining 225 gas regulators, from Apr. 1, 1912, to Dec. 31, 1912, both inclusive; for furnishing gas regulators in public buildings in the borough of Brooklyn; for furnishing, putting in place and maintaining 660 gas regulators, from Apr. 1, 1912, to Dec. 31, 1912, both inclusive; and for furnishing gas regulators in public buildings in the city of New York, in the boroughs of Manhattan and The Bronx.

The Enterprise Bottling Co., Niagara Falls, N. Y., has been incorporated by S. F. and I. F. Roberts and Edmund T. Graham. A bottling plant will be built and equipped.

The Clark Paper & Manufacturing Co. will erect a paper factory and warehouse at 88 Mill St., Rochester, N. Y., early this spring.

The Board of Contract and Supply, of Rochester, N. Y., has awarded the contract for Division No. 8 and part of No. 7 of the sewage-disposal system. Cost, $265,254.

The Matchless Street Cleaning Co., Troy, N. Y., informs us that it does not expect to purchase any new machinery for its new factory located in that city.

The two-story factory at 192 Leonard St., Brooklyn, N. Y., occupied by the Grand Parlor Suit Furniture Co., was damaged by fire, Mar. 13. Loss, $1000, covered by insurance.

The plant of John C. Wiards & Co., 259 Greene St., Brooklyn, N. Y., manufacturers of chemicals, was damaged by fire, Mar. 10. The loss is covered by insurance.

The United Indurated Fibre Co., manufacturer of indurated fiber ware, Lockport, N. Y., is building two additions to its plant, one 33x77 ft., to be used as a tube mill, and the other 88x144 ft., as a dryer.

An explosion and fire caused $20,000 damage to the plant of the Buffalo Weaving & Belting Co., Buffalo, N. Y., manufacturer of cotton webbing, belting, etc.

The city of Middleport, N. Y., will install a complete new sewer and water system at a cost of $100,000.

The five-story building at 163 Canal St., New York, N. Y., occupied in part by M. Banwer, manufacturer of combs, was damaged by fire, Mar. 18. Loss, $1500.

The plant of Darmstadt, Scott & Courtney, manufacturers of paper stock, 178 South St., New York, N. Y., was damaged by fire, Mar. 14. The loss is covered by insurance.

The seven-story building at 97 Wooster St., New York, N. Y., occupied by Adelson Bros., manufacturers of silk waists, was damaged by fire, Mar. 19. Loss, $20,000.

Bids will be received until 3 p.m., Apr. 5, by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for the mechanical system of mail-handling apparatus at the U. S. post office building, New York, N. Y.

White, Gratwick & Mitchell, North Tonawanda, N. Y., will erect two factory buildings, one 40x150 ft., the other 72x80 ft., at Olivet and Seventeenth Sts. The buildings will be occupied by the Standard Stained Shingle Co.

The contract for the construction of the new three-story factory for the Hitchener Wall Paper Co., 319 Broadway, Camden, N. J., has been awarded. It will be 40x70 ft. Lackey & Davis, 1433 Chestnut St., Philadelphia, Penn., are the architects.

The three-story factory of the Marfeld Chocolate & Cocoa Co., 225 New York Ave., Jersey City, N. J., was destroyed by fire, Mar. 18. Loss, $20,000.

The plant of the Kings Shirt Waist Co., Sherman Ave. and Stanton St., Newark, N. J., was damaged by fire, Mar. 19. Loss, $50,000.

Fire damaged the plant of the Anderson Chemical Co., Passaic, N. J. Loss, $50,000.

Sidney Martin, engineer, Penn Building, Pittsburg, Penn., is receiving estimates for the erection and equipment of a powder plant at Wilkes-Barre, for the Burton Powder Co.

The plant of the Walker Grape Juice Co., Erie, Penn., was damaged by fire, Mar. 15. Loss, $6000.

The plant of the Penn Paint & Varnish Co., Lancaster, Penn., was damaged by fire, Mar. 18. Loss, about $5000.

SOUTHERN STATES

Fire destroyed the woodenware manufacturing plant of the Grafton Wooden Works, Grafton, W. Va. Loss, $100,000.

The Bladenboro Cotton Mills Co., Bladenboro, N. C., has announced plans for the construction of a new mill. It will be 103x387 ft., of brick, and cost $35,000. New equipment will be purchased.

The Granite Falls Manufacturing Co., manufacturer of cotton yarns, Granite Falls, N. C., will erect an addition to its plant. It will be 75x227 ft., of brick and steel construction. The estimated cost is $40,000.

The Cannon Manufacturing Co., Kannapolis, N. C., manufacturer of bleached sheeting, is considering plans for the erection of an additional mill and also for a bleachery. It will be three stories high, 200x400 ft. The headquarters are at Concord, N. C.

The Prest-O-Lite Co., Indianapolis, Ind., is to enlarge its plant at Atlanta, Ga., by the erection of a building 40x75 ft., at a cost of $3000. The building operations are in charge of C. B. Floyd, engineer.

The Meyers Ice Co., Barnesville, Ga., is receiving bids for the construction of an ice plant. It will be of ordinary mill construction and will cost $10,000. A. F. Meyers, Dickson, Tenn., is general manager.

The four-story building occupied by the Phoenix Drug Co., Aberdeen, Miss., was destroyed by fire, Mar. 15. Loss, $35,000.

The Southern Paving Construction Co., Chattanooga, Tenn., will soon begin the construction of a creosoting plant in Pensacola, Fla. Two buildings, 26x100 ft., and 22x100 ft., will be erected of fireproof construction. The estimated cost is $75,000.

Edmund H. Anderson, Nicholasville, Ky., will erect an electric-light plant and ice factory, at Crab Orchard Springs, Ky. A central steam-heating plant will be erected later.

Waverly, Ky., is arranging for the installation of an electric-light plant.

Plans are being considered by A. Waller & Co., grain merchants, Sturgis, Ky., for the construction of a new grain elevator.

S. W. Easley, Williamsburg, Ky., is considering plans for the construction of an ice plant at this place. It will be of fireproof construction.

MIDDLE WEST

Plans are being prepared for the Columbus Contractors Supply Co., Deshler Building, Columbus, Ohio, for the construction of a new factory. It will be one story high, 150x150 ft., and cost $50,000.

Plans are being prepared by Bacon & Huber, Archs., 754 Spitzer Building, Toledo, Ohio, for the construction of a new factory for J. H. Bellows, 417 Nasby building. It will be two stories and basement, 100x132 ft.

The Modern Vulcanizing Co., Bowling Green, Ohio, has been incorporated by E. H. Fries, R. D. Hunter and others to operate a vulcanizing plant for rubber goods.

The Nelson Lumber Co., Columbus, Ohio, which was just incorporated for $150,000, by C. Nelson, F. Schmidt and others, will purchase wood-working machine tools for mill work.

The mill of the Moody & Thomas Flour Co., 6312 Kinsman St., Cleveland, Ohio, was destroyed by fire. New milling machinery will be needed for new plant which is to be built.

The Hamler Grain Co., Hamler, Ohio, will erect a new elevator. J. Brown is superintendent.

The Valley Furniture & Manufacturing Co., Marietta, Ohio, maker of furniture, has raised its capital to $150,000. A large amount of money will be spent on new woodworking tools and power-plant changes.

The Booth Column Co., Toledo, Ohio, maker of wooden building columns, will buy woodworking machinery for its factory.

The Belting Co., Cleveland, Ohio, makers of leather belts, will equip a new plant.

The Sweet Valley Wine Co., Sandusky, Ohio, wine maker, has raised its capital to $200,000, and will buy new power-plant equipment.

The Reserve Lumber Co., Cleveland, Ohio, just incorporated, to operate a lumber business, by W. S. Lister, A. C. Wald and others, will soon buy some woodworking machinery.

The Columbia Chemical Co., Barberton, Ohio, will make additions to power plant.

The Zehner Bros. Packing Co., Bellevue, Ohio, has increased its capital to $1,000,000, and will improve and enlarge its meat-packing plant.

Fire, on Mar. 13, caused $45,000 damage to building in Canton, Ohio, occupied in part by the Canton Home Furnishing Co., the Twentieth Century Electric Co., and the Canton Sign Co.

The Gwinn Milling Co., Columbus, Ohio, will soon start the erection of a $75,000 addition to its plant located at the N. & W. tracks and East Main St.

The Wabash Pottery Co., Roseville, Ohio, will build a new plant. David Melick is general manager.

The Star Stoneware Co., Crooksville, Ohio, will build an addition to its plant. Noted Mar. 14.

Navarre, Ohio, will build a new municipal water-works system.

The Star Furnace Co., Jackson, Ohio, will make extensive improvements to its plant. New power plant and other machinery will be installed.

The Smart Manufacturing Co., Indianapolis, Ind., is equipping a factory at 336 West Vermont St., for the manufacture of puncture-proof pneumatic tires.

The Wayne Oil Tank & Pump Co., Fort Wayne, Ind., has awarded a contract to the Pan-American Bridge Co., New Castle, Ind., for furnishing and erecting the steel structure for its new shop, 70x200 ft. Plans were prepared by A. W. Grosvenor, 310 Bank Block, Fort Wayne, Ind., the architect.

The John A. Rowe Cut Stone Co., Bedford, Ind., whose plant was recently destroyed by fire, is now receiving bids for the erection of a new building on the old site. The structure will be of steel and brick, T-shaped, and will be 47x120 ft. at one end and 57x150 ft. at the other.

The Farmers Equity Union, of South Whitney, Ind., has ordered plans on which bids will soon be asked for the construction and equipment of a large elevator between the Vandalia and the Nickel Plate railroads. Louis Miehler is president.

A grain elevator owned by the Crabbs-Reynolds-Taylor Co., at Wingate, Ind., was destroyed by fire, Mar. 7. Loss, $20,000, covered by insurance.

R. H. Marr, 1529 Ford Building, Detroit, Mich., has awarded the contract for the two-story and basement laundry, 40x102 ft., for the Monarch Laundry Co., 345 Woodward Ave., to Duhisle & Cooper, 383 McDougall Ave., at $25,000. Noted Mar. 14.

The Belcarmo Nut Butter Co., J. D. Carpenter, manager, 16 Huron St., Grand Rapids, Mich., is having plans prepared for a two-story factory, 80x200 ft. The estimated cost is $50,000.

Fire destroyed the plant of the New Aetna Cement Co., Fenton, Mich., to the extent of $100,000.

The plant of the Charlevoix Mineral Water Co., Charlevoix, Mich., recently destroyed by fire at a loss of $6000, will be rebuilt.

Bids will be received by the Board of Public Works, of Grand Rapids, Mich., until 8 p.m., Mar. 28, for three 75-kw. single-phase transformers. Samuel A. Freshney is secretary.

The contract for the construction of a factory for Grommes & Elson, 2 Franklin St., Chicago, Ill., has been awarded to Haugen Bros., 3339 Evergreen Ave., at $35,000. It will be three stories high, 48x100 ft.

D. S. Klafter, architect, 127 North Dearborn St., Chicago, Ill., is receiving bids for a soap factory for Hines Bros. Co., 4023 South Ashland Ave. It will be three stories high, 50x75 ft., and cost $30,000.

The plant of the MacLean Drug Co., 4541 Evanston Ave., Chicago, Ill., was practically destroyed by fire, Mar. 15. Loss, about $20,000.

J. J. Bemer, Pawpaw, Ill., has been granted a franchise for the construction and operation of a public service electric plant and will begin construction thereof at once.

The Rockford Light Furniture Co., Rockford, Ill., has increased its capital stock from $15,000 to $25,000, and will increase its capacity.

The Rockford Desk Co., Rockford, Ill., whose plant was recently destroyed by fire, will soon begin the erection of new buildings on the site of the former.

Plans have been announced by Beck & Schwartz, owners of the Lancaster Cheese Co., Lancaster, Wis., for the erection of a two-story cheese factory in Barnum, Wis. It will be of brick and steel construction.

The Hoffman & Penn wagon shop, at Ripon, Wis., was burned. Loss, $4000.

WEST OF THE MISSISSIPPI

The Des Moines City Ry. Co., Des Moines, Iowa, contemplates an expenditure of $95,584, for new power-plant equipment. J. E. Ralston, Des Moines, is superintendent of power.

H. A. Morey and Jas. J. Donelan, of Waverly, Iowa, propose to erect and install a gas plant at New Ulm, Minn.

The Grand Trunk Pacific Ry. Co., Duluth, Minn., is planning to erect a grain elevator of 4,000,000 bushels capacity.

The City Council of Rochester, Minn., is considering the installation of additional equipment in the municipal electric-light plant. J. A. Eichinger is superintendent.

The Board of Public Service, of St. Paul, Minn., has awarded the contract for the Thomas-Van Buren St. sewer system, at $34,000.

The installation of additional generating equipment in the municipal electric-light and power plant, at Butler, Mo., is under consideration. Charles W. Miller is engineer.

The Elliott elevator, Rolla, N. D., was destroyed by fire, Mar. 11. Loss, $10,000.

A. K. Bass, of De Leon, Tex., is installing an electric-light and power plant at Eastland, Tex.

The Lott Electric Co., Lott, Tex., is rebuilding its electric-light and power plant here.

The Jenner Manufacturing Co., San Antonio, Tex., recently organized with a capital stock of $50,000, will install a plant for manufacturing and bottling carbonated waters and various kinds of soft drinks. The incorporators are J. W. Judson, Edward J. Jenner, Walton D. Hood, H. L. Leick and J. R. Hood.

The Texas Coffin Co. is considering plans for the construction of a new veneer factory, at Waco, Tex. It will be of brick, 60x150 ft.

The Boss Rubber Co., 1614 Broadway, Denver, Colo., is constructing a complete plant for the manufacture of inner tubes for tires. The factory will be provided with machinery and equipment capable of producing from 50 to 100 tubes per day.

The city of Ilo, Idaho, has voted bonds for the installation of a water-works system.

The Lewiston-Clarkston Cannery Co., Juliaetta, Idaho, will soon commence the erection of a new fruit-canning plant here.

A. Welch and associates, of Lewiston, Idaho, will install a large power plant with 40,000 hp. capacity, at Horseshoe Bend, on the Salmon River, Idaho.

A contract for constructing a gravity water system at Preston, Idaho, has been awarded. Cost, $57,827. The system will contain 21 miles of pipe line.

WESTERN STATES

The Pacific Coast Coal Co., Renton, Wash., will erect a factory for the manufacture of briquettes. Estimated cost, $225,000.

The Washington Fruit Evaporating Association, Port Angeles, Wash., will establish six evaporating plants at a cost of $15,000.

Fire damaged the plants of the Zillah Paint Co., and the Zillah Electric Co., Zillah, Wash., Mar. 6. Loss, $6000.

Fire destroyed the factory of the Excelsior Glove Co., Bellingham, Wash., operated by C. R. Norman. Loss, $2000.

The Purity Paper Bottle Co., Washington, D. C., contemplates the erection of a new manufacturing plant at Centralia, Wash.

Captain E. Slover, Chehalis, Wash., is contemplating the erection of a powder-manufacturing plant at Eugene, Ore.

The Pacific Ammonia & Chemical Co., St. Louis, Mo., has acquired a site on Lake Union, near Seattle, Wash., and will erect a new manufacturing plant, estimated to cost $170,000. Robert F. Geer is president.

The Spokane Furniture Co., Spokane, Wash., will build an addition to its plant on Matin St.

A. Sullivan and R. A. Eayerwather, Dayton, Wash., will erect a pickle-manufacturing plant at Longs, near Dayton.

The city of Butte Falls, Ore., has voted bonds for the installation of a water-works system. About $10,000 will be expended.

A. L. Morris, San Francisco, Calif., will establish a new laundry plant in Chico, Calif. The machinery equipment will cost about $8000.

The Union Ice Co., Bakersfield, Calif., will soon commence the erection of an ice-manufacturing and cold-storage plant at Terra Bella, Calif.

The city of Orland, Calif., is planning for the installation of a municipal water and sewer system.

The South Coast Land Co., Oceanside, Calif., is planning for the installation of a pumping plant in the San Luis Rey River, above Oceanside, to cost $50,000.

A. H. Mooser and associates, San Francisco, Calif., are contemplating the erection of a canning plant at Grass Valley, Calif.

Bids will be received until 2 p.m., Apr. 8, by the U. S. Reclamation Service, Los Angeles, Calif., for furnishing electrical apparatus for the Truckee-Carson Project, Nevada. For particulars address the U. S. Reclamation Service, 605 Federal Building, Los Angeles, or Washington, D. C. F. H. Newell is director.

The Northern California Power Co. contemplates the installation of new equipment in its substation at Chico, Calif. E. V. D. Johnson, Redding, is manager.

Bids will be received by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., until Apr. 4, for an electric vault-protection system in the U. S. post office and court house, at San Francisco, Calif.

Robert S. Lovett, who holds the majority of control of the Associated Oil Co., Wells-Fargo Building, San Francisco, Calif., has approved the plan to build a large refining plant. It is proposed that the plant be built in Contra Costa County, there being three sites in view. It will cost $1,000,000.

The Alameda Sugar Co., Alaska Commercial Building, San Francisco, Calif., has purchased about 10,000 acres of land in District No. 70, and is about to construct a beet-sugar factory, with a capacity of 600 tons of beets per day. It will be located on the line of the new Northern Electric Ry., near Meridian.

The Porcelain Works, Richmond, Calif., has erected an addition to its factory and will install new machinery. The estimated cost is $50,000.

The Vitrified Brick & Clay Products Co., San Diego, Calif., will erect a factory on Davidson St. for the manufacture of vitrified brick, sewer pipe, drain tiles, electrical conduits, hollow ware and all kinds of brick. C. E. Anthony is interested.

CANADA

The four-story building at 620 and 622 St. Paul St., Montreal, Que., occupied by the Vogal Co., of Canada, Ltd., the King Hat Co., the American Paper Box Co., and the Canadian Quilting Co., was damaged by fire, Mar. 13.

Fire totally destroyed the sash and door factory of the Radford-Wright Co., Ltd., Winnipeg, Man. Loss, $50,000, covered by insurance.

The Barber Mattress Co., Vancouver, B. C., has applied to the city council of Victoria, B. C., for a permit to erect a new manufacturing plant on Topaz St.

Bids will be received by the city commissioners of Moose Jaw, Sask., until Mar. 30, for one 1500-kw. alternating-current steam turbo-generator set and one 500-kw., alternating-current generator, direct-connected to a Diesel oil engine. E. B. Bonnell is city clerk.

The Hare Engineering Co., Ltd., manufacturer of steam power specialties, 14 East King St., Toronto, Ont., will erect and equip a foundry and machine shop, at Galt, for the manufacture of heavy machinery.

The Holman Electric Sign Manufacturing Co., Toronto, Ont., will remove its plant to Welland, Ont., having purchased a building for a factory.

NEW INCORPORATIONS

METAL

The Jackson Petroleum Motor Co., Augusta, Maine, has been incorporated, with a capital of $500,000. E. M. Leavitt is president and treasurer.

The Omaha Motor Co., Augusta, Maine, has been incorporated, with a capital of $1,000,000, to manufacture motors. The incorporators are R. S. Buzzell and E. J. Pike, both of Augusta.

The Bennington Scale Co., Montpelier, Vt., has been incorporated, with a capital of $100,000, to manufacture scales and all kinds of weighing instruments and apparatus.

The Puritan Mailing Machine Co., Boston, Mass., has been incorporated, with a capital of $100,000. The incorporators are Joseph A. Mahoney, 1238 Commonwealth Ave., Boston, and Annie E. Flaherty, 47 H St., South Boston.

The Turnball Auto Co., Willimantic, Conn., has been incorporated, with a capital of $25,000, to conduct a garage. The incorporators are David A. Turnball, Frederick J. Wood, William M. Turnball, all of Willimantic.

The Reeves Vacuum Cleaner Co., Milford, Conn., has incorporated, with a capital of $5000, to manufacture vacuum cleaners. The incorporators are William Reeves, Edwin Reeves and Roscoe Reeves.

O. E. Short & Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture motors, engines and machinery. The incorporators are C. P. Fall, E. J. Welch and H. L. Starr.

The Smith-Ryan Boat & Engine Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture motors and engines. The incorporators are C. B. Campbell, T. J. Tracy, M. J. McMullin, New York.

The John Wieben Co., New York, N. Y., has been incorporated with a capital of $100,000 to manufacture sanitary fixtures. The incorporators are J. Wieben H. Wieben and P. Holland, New York.

The Knickerbocker Railway Supply Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture railway equipment. The incorporators are G. H. Williams, Erie, Penn.; R. C. Fraser, Suffern, and J. P. Fallon, Brooklyn, N. Y.

The Blair Tool & Machine Works, New York, N. Y., has been incorporated, with a capital of $15,000, to manufacture tools and machinery. The incorporators are John J. Dobson, 4 Appolo St., Jersey City, N. J.; William E. Rankin, 10 Burnett St., Newark, N. J., and George Presigke, 451 Grand View Ave., Brooklyn, N. Y.

The H. Shapiro Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture tinware. The incorporators are H. Shapiro, C. Shapiro and J. D. Goodhart.

The Protection Registers Co., Buffalo, N. Y., has been incorporated, with a capital of $150,000, to manufacture cash registers. The incorporators are W. J. Penfold, C. S. Haber, Buffalo, and E. H. Haber, Lockport.

The Central New York Engineering & Equipment Co., Geneva, N. Y., has been incorporated, with a capital of $100,000, to manufacture electrical and mechanical engines. The incorporators are J. H. Sharpe, Geneva, and F. and M. H. Bowers, Penn Yan, N. Y.

The American Knife Co., Baldwinsville, N. Y., has been incorporated, with a capital of $30,000, to manufacture knives and tools. The incorporators are A. J. Tooley, Baldwinsville; J. H. Mather, Syracuse, and J. H. Nichols, Greenfield, Mass.

The Control Manufacturing Co., Albany, N. Y., has been incorporated with a capital of $100,000 to manufacture metal castings. The incorporators are W. J. Kerwin, E. T. Newcomb and J. P. Coughlin, Albany.

The George F. Shevlin Manufacturing Co., Saratoga Springs, N. Y., has been incorporated with a capital of $600,000 to operate a foundry. The incorporators are G. F. Shevlin, Saratoga Springs; T. Kerley, Ballston Spa, and C. R. Kilmer, Saratoga Springs.

The Bridgeton Chandelier Co., Bridgeton, N. J., has been incorporated with a capital of $100,000 to manufacture gas fixtures and chandeliers. The incorporators are J. L. Rice, W. C. Rice and J. D. Reeves, Bridgeton.

The Nipper Machine Co., Norma, N. J., has been incorporated with a capital of $25,000 to manufacture machinery. The incorporators are M. Feis, Philadelphia, Penn., and E. H. Sawyer, Vineland.

The Acme Twist Drill Co., Newark, N. J., has been incorporated with a capital of $300,000 to manufacture high-speed drills. The incorporators are J. W. Ebbs, Englewood Cliffs; A. A. Kelley, Montclair; R. H. Waddell, New York.

The Y. & G. Electric Fuse & Engineering Co., Bayonne, N. J., has been incorporated with a capital of $100,000 to manufacture electric motors, electrical machinery and dynamos. The incorporators are R. Holdenberg, J. J. Kuder, Bayonne; W. R. Reid, Montclair.

The Perry Manufacturing Co., Jersey City, N. J., has been incorporated, with a capital of $350,000, to manufacture railway apparatus and hardware. The incorporators are A. I. Drayton, M. J. Currie and G. J. Fermier, Jersey City.

The Hot Water Gas Stove Co., Philadelphia, Penn., has been incorporated, with a capital of $500,000, to manufacture gas stoves and attachments for same. The incorporators are A. M. Henderson, M. K. Henderson and G. B. Carr.

The Phoenix Machine Co., Wilmington, Del., has been incorporated, with a capital of $50,000. The incorporators are M. L. Rogers, S. E. Roberson and H. W. Davis.

The United States Enameling Co., Moundsville, W. Va., has been incorporated, with a capital of $10,000, to manufacture sheet metal, enameled goods and galvanized iron. The incorporators are E. L. Evans, Moundsville, W. Va.; W. T. Hughes and R. D. Hughes, both of Shadyside, Ohio.

The Clifton, Pratt Co., Cincinnati, Ohio, has been incorporated, with a capital of $10,000, to manufacture pumps, vacuum cleaners and other machinery. The incorporators are A. E. Clifton, Charles H. Pratt and A. H. Evans.

The Verdin, Kappes & Verdin Co., Cincinnati, Ohio, has been incorporated with a capital of $25,000 to manufacture sheet-metal working machinery. The incorporators are W. H. Kappes, I. T. Verdin ad H. A. Bolsinger.

The Columbus Vending Co., Columbus, Ohio, has been incorporated, with a capital of $125,000, to manufacture automatic vending machines. The incorporators are H. C. Ferriman, H. L. Michell and L. V. Kuhn.

The Wise-Harrold Electric Co., New Philadelphia, Ohio, has been incorporated, with a capital of $30,000, to manufacture electrical appliances. The incorporators are W. J. Wise, H. H. Harrold, A. E. Wise and T. B. Stroup.

The Cleveland Automatic Clock Co., Cleveland, Ohio, has been incorporated, with a capital of $250,000, to manufacture automatic clocks and lighting devices. The incorporators are H. P. Shupe, C. A. Bond and F. L. Fuller.

The Cleveland Metal Joint Co., Cleveland, Ohio, has been incorporated, with a capital of $35,000, to manufacture metal joints for pipes and cables. The incorporators are Richard M. Corcoran, P. H. Sugrea and Henry W. Lannert.

The Reno-Kaetker Electric Co., Cincinnati, Ohio, has been incorporated, with a capital of $15,000, to manufacture electrical machinery. The incorporators are Frank P. Colville, Henry Koetker and Stanley H. Parvin.

The Massillon Pipe & Foundry Co., Massillon, Ohio, has been incorporated, with a capital stock of $10,000. The incorporators are George Cook Ford, John H. Watson, Jr., and W. D. Turner.

The Sprague Iron Works, Chicago, Ill., has been incorporated, with a capital of $5000, to manufacture metal products. The incorporators are E. S. Sprague, John P. Larson and J. C. Sprague.

Trade Catalogs

Pyott Co., Chicago, Ill. Catalog. Cast-iron pulleys. Illustrated, 112 pages, 6x9 in.

S. A. Woods Machine Co., Boston, Mass. Catalog. Inside molders. Illustrated, 44 pages, 6x9 in.

South Bend Machine Tool Co., South Bend, Ind. Catalog No. 42. Engine lathes. Illustrated, 36 pages, 6x9 in.

Celfor Tool Co., Buchanan, Mich. Catalog No. 11. Drills, reamers, chucks, boring tool, etc. Illustrated, 34 pages, 6x9 in.

Walker Grinder Co., Worcester, Mass. Circular D. Single-stroke surface grinder for flat and concave surfaces. Illustrated.

Lakeside Forge Co., Erie, Penn. Catalog. Drop forgings, drop-forged wrenches, etc. Illustrated, 52 pages, 5x7 in.

The Geometric Tool Co., New Haven, Conn. Catalog. Die heads, collapsing taps, threading machines. Illustrated, 88 pages, 4x7½ in.

J. T. Slocomb Co., Providence, R. I. Catalog No. 13. Calipers, reference disks, centering tool, center drills, etc. Illustrated, 62 pages, 5x7½ in.

American Electric Tool Co., West Newton, Mass. Bulletins Nos. 1 and 3. Portable electric drills. Bulletin No. 2. Portable electric bench and tool post grinder. Illustrated.

Smooth-On Manufacturing Co., 572 Communipaw Ave., Jersey City, N. J. Instruction Book No. 11. Concrete Iron cement No. 7. Illustrated, 24 pages, 4½x6½ in.

Forthcoming Meetings

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

National Metal Trades Association. Fourteenth annual convention, Apr. 11, Hotel Astor, New York City. Robert Wuest, commissioner, New England Building, Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. Charles E. Hildreth, secretary, Worcester, Mass.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

FOREMAN—Thoroughly competent for head of planer department, who is conversant with modern planing methods; references required. The Whitlock Printing Press Mfg. Co., Derby, Conn.

A MAN experienced in cold-rolling spring steel in all gages from 0.003 up to ⅛ in. and drawing spring wire; must know what equipment is necessary and how to install same. Address P. O. Box 941, New Haven, Conn.

Florida

FOREMAN for machine shop working 20 men all around, doing a general jobbing business; we want a man that can reduce costs and turn the work out; a man that knows what a machine will do; in other words, we want a hustler and a mechanic; state age, married or single, reference and salary in first letter. Box 106, Am. Machinist.

Maryland

DRAFTSMAN, experienced on high-speed stationary engines. Box 112, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

TOOL DESIGNERS, experienced; specialty on jigs and fixtures; state experience and wages expected. Apply Employment Department, General Electric Co., Pittsfield, Mass.

SUPERINTENDENT for an established manufacturing plant making fine tools in New England; must be superior experienced American mechanic, tool maker and designer; capable of managing 200 skilled machinists; salary, $2000 to $4000; buildings, equipment, power, costs, etc., are handled by the manager. Box 81, Am. Machinist.

Michigan

ORDER CLERKS—Two young men for production order clerks, with large manufacturing concern in Michigan; good wages; opportunity for advancement exceptionally good; experience necessary; should be able to read drawings. Box 128, Am. Machinist.

FOREMAN machine room, at once by Michigan manufacturer in fine town of six thousand people; this shop makes mostly small brass parts, also priming cups, gasoline stop cocks, etc.; only first class, married man wanted, one familiar with ground key work preferred, but not absolutely required; in answering state wages wanted and give references. Box 109, Am. Machinist.

CHIEF DRAFTSMAN—Wanted at once by one of the oldest and largest manufacturers of high-grade motor cars; must be a man with considerable automobile experience who can command and maintain the respect of all with whom he comes in contact; must have sufficient executive ability to enable him to handle a large force and turn out the work in a thorough and systematic manner, with rapidity without sacrificing neatness and accuracy. Box 87, Am. Machinist.

Missouri

DIE MAKERS, first-class; do not apply unless you are familiar with our line of work and capable of earning the highest wages. Dalton Adding Machine Co., Poplar Bluff, Mo.

New Jersey

DESIGNER on tools and machinery for small interchangeable parts. Box 73, Am. Machinist.

LATHE HAND, experienced, on machine tool work; wages 32½c.; none but first class man need apply. Address "Supt.," De Laval Steam Turbine Co., Trenton, N. J.

New York

MACHINIST—Steady work to good man; 30c.; state age and experience. Box 101, Am. Machinist.

DRAFTSMEN for jig, fixture and general tool work. Apply Mergenthaler Linotype Co., 20 Ryerson St., Brooklyn, N. Y.

MECHANICAL DRAFTSMAN, who is familiar with gas-engine design, both two- and four-cycle horizontal type; give experience. McEwen Bros., Wellsville, N. Y.

SALESMAN—An importer of ball bearings requires the services of a salesman for territory west of New York; must have technical training, selling experience, and good references; permanent

and growing position for a man who can make good. Box 94, Am. Machinist.

MECHANICAL DRAFTSMAN or man experienced in general machine work; give experience and wages wanted. McEwen Bros., Wellsville, N. Y.

Ohio

MECHANICAL DRAFTSMAN, with experience on machine-tool work. Cleveland Automatic Machine Co., Cleveland, O.

TRAVELING ENGINEER for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

INSPECTOR, at once, by Ohio manufacturer; man experienced in automatic engines of the single and four-valve types to act as inspector, and if necessary, foreman of machine work and erection; replies must give full particulars of experience, salary desired, etc., and will be treated strictly confidential. Box 70, Am. Machinist.

MECHANICAL DRAFTSMAN, at once, by Ohio manufacturer, who has had automatic-engine experience and who is thoroughly familiar with strength of materials and automatic engines of the single and four-valve types; replies must give full details of experience and salary desired and will be treated strictly confidential. Box 69, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL DESIGNERS for jigs, fixtures and special tools. Address the employment office of Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

POSITIONS WANTED

Connecticut

TOOL MAKER, mechanic, first-class on adding machines, automatic guns, would take charge. Box 123, Am. Machinist.

TOOL MAKER, competent; technical education; 10 years' experience on tools, dies, automatic machines; speedy; good designer; able to handle men; wish to change. Box 110, Am. Machinist.

DESIGNER, tool and machine; technical mechanic; graduated; eight years' experience on automatic machines, tools and dies; speedy calculator, logarithms and square root. Box 111, Am. Machinist.

PRODUCTION ENGINEER — Young technical and practical man desires permanent position; eight years' experience in efficiency engineering in the various branches of metal trades. Box 120, Am. Machinist.

Maine

JUNIOR DRAFTSMAN by young man with good training for the work; 22; single; worker; give me a chance. "P. W. B.," R. F. D. 45, Albion, Maine.

Massachusetts

PLANER FOREMAN, 45, thirty years' experience on light and heavy machine tools, 12 years foreman, wants position in plant where place would be worth a salary of $2000. Box 103, Am. Mach.

PURCHASING AGENT, four years with corporation buying for ten automobile manufacturers, thoroughly familiar with factory costs and systems, desires position with manufacturing company not in a combine; location immaterial. Box 107, Am. Machinist.

SUPERINTENDENT, assistant, or toolroom foreman position wanted; am 35, and 17 years experienced tool maker and designer of modern labor-saving tools for economical production of interchangeable parts; executive ability and systematizer; been master mechanic and toolroom foreman for years with large concerns; now tool-room foreman of plant employing 2000. Box 124, Am. Machinist.

New Jersey

MECHANICAL DRAFTSMAN, practical mechanic, wishes position office or factory; location immaterial. Box 90, Am. Machinist.

DESIGNER, with first-class experience on automatic and special machinery; original ideas; technical education and shop experience. Box 125, Am. Machinist.

SUPERINTENDENT in small or medium sized shop by young man experienced in similar position; technically educated; a high-class original designer; well acquainted with uptodate tools and methods and tactful with men. Box 126, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 119, Am. Machinist.

TOOL MAKER and mechanic, first-class, uptodate; expert on modern jig work; want to take charge of tool room or small machine shop. Box 115, Am. Machinist.

CHIEF DRAFTSMAN or designer, experienced man, wants position on general or automatic machinery; technical education; good references. Box 99, Am. Machinist.

EFFICIENT STOREKEEPER, experienced in general mill supplies and tools; knowledge of factory office work and repair shop timekeeping. Box 102, Am. Machinist.

MECHANICAL ENGINEER, draftsman and designer; 16 years' experience; expert in designing tools and labor-saving devices; have inventive abilities; responsible position desired. Box 117, Am. Mach.

FOREMAN, tool room; a thorough, first-class man, particularly on dies, with uptodate ideas and capable of making his own drawings; now employed as such, wishes to make a change. Box 65, Am. Machinist.

ASSISTANT SUPERINTENDENT — Young man, 22, with concern manufacturing mechanical specialty; experienced drafting, pattern making and foundry work; able to take hold of responsible matters; highest references. Box 114, Am. Machinist.

ASSISTANT SUPERINTENDENT — A man with wide practical experience in tool room and experimental work desires responsible position as foreman or department head in manufacturing plant; highest references furnished. Box 113, Am. Machinist.

SUPERINTENDENT, tool designer; married man, age 33 years; a thorough mechanic, experienced as machinist, draftsman and executive on machine tools, electrical, hydraulic, transmission and experimental machinery; has record as production superintendent where keen competition has made low cost and improved product imperative; would connect with live concern where ability and push will have its legitimate results. Box 122, Am. Machinist.

SUPERINTENDENT, expert mechanic, familiar with modern methods in shop and office; successful producer at low costs on machine tools, steam pumps, automobile accessories and general engineering work; experienced on printing machinery, also on new plant layout equipment and organization; at present in charge of entire plant, including iron and brass foundries; open to offer of high-grade firm; highest references from present and past employers; location anywhere if healthy. Box 129, Am. Mach.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

A POSITION of responsibility by a man of wide experience; good executive and a producer; familiar with the cost system; thoroughly capable in office, tool room and shop. Box 118, Am. Machinist.

Pennsylvania

MECHANICAL SUPERINTENDENT, expert mechanic, engineer, wants to make good connection; moderate salary. Box 95, Am. Machinist.

TOOL MAKER, 28, with 12 years' all-around experience on close work desires position in or around New York; could take charge of inspection department. Box 127, Am. Machinist.

Rhode Island

SUPERINTENDENT, general foreman; have unit times tabulated; A1 results for A1 salary. Box 121, Am. Machinist.

FACTORY ENGINEER, machine and tool designer, demonstrator, speed boss, rate setter, have time studies tabulated; can tune up your plant. Box 60, Am. Ma.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

Designs and investigations undertaken in mechanical engineering. Address Box 92, Am. Machinist.

For Rent—Two-story brick factory, 7500 sq.ft., Plainfield, N. J. A. J. Brunson, Plainfield, N. J.

Removal—On Mar. 1 we moved to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

Mechanical drafting and designing, labor-saving tools designed, inventions perfected. Box 116, Am. Machinist.

Patent drop forged spanner U. S. A. patent granted; manufacturing rights offered for sale; great sales in Europe. Write Box 105, Am. Machinist.

For Sale—Friction pulley and universal grinding attachments patent for sale; also Canada patent outright. For full particulars address R. Rosner, Madison, Wis.

For Sale—Patent, patterns, drawings, cuts and an elaborate equipment of small tools for the manufacture of the very best line of machine tools of their kind on the market. Box 108, Am. Machinist.

For Sale or Rent—In village of Albion, substantial stone building, 50x127 ft., from street to barge canal; well adapted for foundry and machine shop; no foundry within 10 miles or more; good location for business. G. H. Church, Bergen, N. Y.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

Machinists—Do you want to earn a day's pay during the noon hour? We are offering big inducements to hustlers in every machine shop in the country; a bonafide business proposition; no triflers need apply; write for particulars. Alert Tool Co., 221-223 N. 23rd St., Philadelphia, Penn.

Business man wanted with capital, to join engineer who has new marine motor of great promise, which can also be worked into the stationary field; fine plant with small stable business in marine motors, located in Connecticut, can be leased at nominal figure for the purpose. Address "Motor," Am. Machinist.

Drawings, specifications, estimates and manufacture of jigs, fixtures, automatic machinery, special equipments, punches and dies by a corps of experts; write us your requirements for suggestion of ideas and cost estimates. Laurin & Sundstrom, 271 Hicks St., Brooklyn, N. Y.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

If there is one contributor to our columns who always has his feet on the ground, who gets near to the heart of his readers, and whose articles are among the most widely read, it is Osborne, of Oil Country fame.

We'll all be interested in a recent experiment of his.

* * *

He says: "Once, when I was talking to a bright young man who was working in the shop, I spoke to him about something that had appeared in the AMERICAN MACHINIST, and was surprised to learn that he did not take it. I wished to know why and was told that he did not like paying for a lot of 'stuff' that was not of any use to him. The 'stuff' that he referred to was the advertising parts of the paper. He could see that they might be of value to me and to a few other men, but did not believe that they were of value to most subscribers.

"Wishing to get at the opinion of others of my friends I went to a number on a tour of investigation. This investigation was among men who were not directly concerned with buying, but had to do with men who were machinists, none of whom held a position higher than department foreman.

"The information was gathered from each man separately. "'If you could have your choice at the same price would you rather have your paper without any of the advertising parts?' Not one of them wanted his paper that way.

"'You now pay $4.00 a year for your paper. What would you be willing to pay a year for the reading matter only?'

"This question very few were willing to answer without some explanation. Evidently most of them had never considered the possibility of any such a separation, and it was hard to put a cash value on the parts, but here is a fact. The longer they thought the matter over the higher they put the value of the advertisements. Here are some of the answers.

"'I don't know as I would give $3.00 for it.'

"'I might give $2.00 for it, but I would want to think it over first.'

"'I would rather give $4.00 for it as it is than to give $1.00 for it that way.'

"'If it wasn't for the advertisements I wouldn't be taking it this long. Whenever I find a lot of reading that I can't understand I look to see if there isn't something new in the tool line.'

"One man was running an extremely nice and convenient geared head lathe. 'How about this lathe if I hadn't been reading the advertisements?'

"That was answer enough for I knew the story. The lathe was used for toolmaking. The shop had been crowded with work and some new tools were needed and this man suggested that if the advertisement was true and the price was not too high such a lathe might be a good one for the job.

"The superintendent had not noticed the advertisement or heard of the lathe, but he sent for particulars. The man believed that he could more than save interest on the difference in price and has the lathe. It is the only one of the make in the shop, although it is not the only tool that has been bought because of suggestion from workmen who have been watching the advertising columns.

"I found that most of the men in the office began at the advertising end and that at least some of them never got to the reading matter at all."

* * *

Only reliable products can be continuously advertised.

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FOR TURNING HOLLOW COLUMNS:
Without the aid of cast bars in the ends.

TOOL FOR RESEATING NIPPLES AFTER DAMAGE TO GRATING:
It is accurate and obviates delay and annoyance.

A QUICK RELEASING FIXTURE:
A good time saver.

A TRIANGLE FOR THE UNIVERSAL DRAFTING MACHINE:
For inking short lines or small drawings.

A BABBITTING METHOD:
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That combined two operations.

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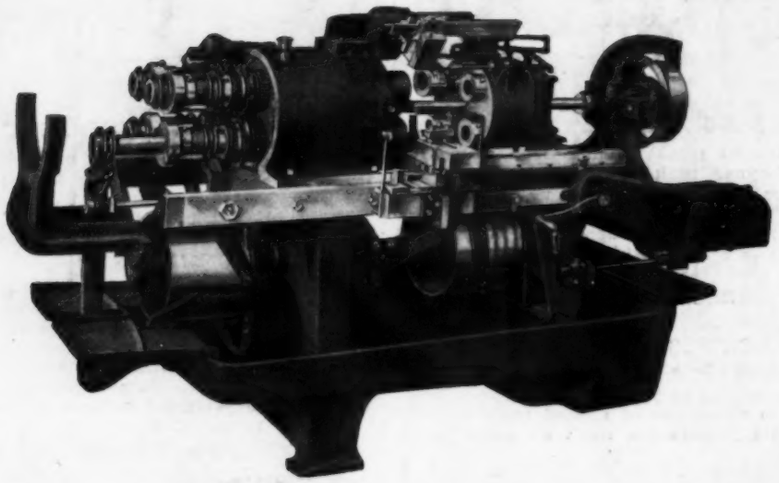

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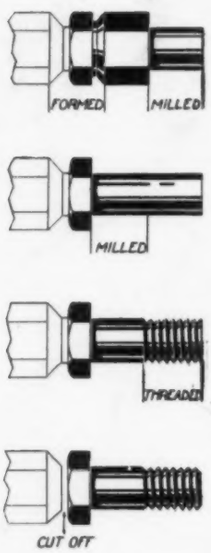
reduced 40 to 200% on Parts



FEW parts are simpler or more commonly used than the ordinary Cap Screw. These are the product of Screw Machines to the extent of hundreds of thousands of a single kind.

The time for the completion of any piece on the Acme is never longer than one operation. But here the advantage is double since the milling was done in one half the time it takes to do it by a single cut, and the other operations came within that time.

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